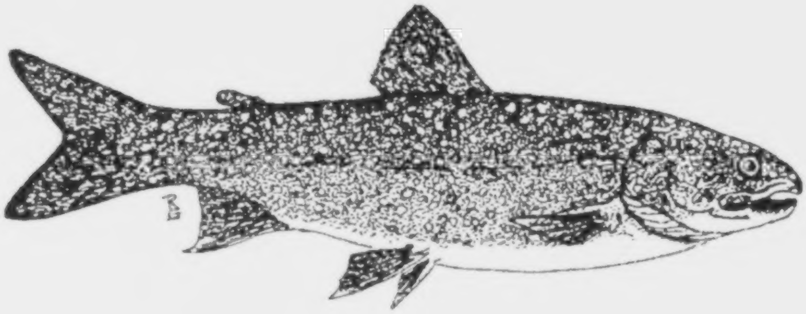
Lake Trout Stocking in Inland Lakes: An Annotated Bibliography and Literature Review

S. J. Kerr and T. A. Lasenby
Fisheries Section
Fish and Wildlife Branch
Ontario Ministry of Natural Resources

January 2001

Ontario

Lake Trout Stocking in Inland Lakes: An Annotated Bibliography and Literature Review



105-04213/

This publication should be cited as follows: Kerr, S. J. and T. A. Lasenby. 2001. Lake trout stocking in inland lakes: An annotated bibliography and literature review. Fish and Wildlife Branch, Ontario Ministry of Natural Resources. Peterborough, Ontario. 178 p. + appendices

Printed in Ontario, Canada
(0.3 k P. R. 01 15 01)
MNR 51463
ISBN 0-7794-0490-4

Copies of this publication are available from:

Fish and Wildlife Branch
Ontario Ministry of Natural Resources
P. O. Box 7000
300 Water Street, Peterborough
Ontario. K9J 8M5

Cette publication spécialisée n'est disponible qu'en anglais

Cover drawing by Ruth E. Grant, Brockville, Ontario.

Preface

This annotated bibliography is the fifth in a series of reference documents developed in conjunction with a review of fish stocking policies and guidelines in the Province of Ontario. It has been prepared to summarize information pertaining to the current state of knowledge regarding lake trout stocking in a form which can readily be utilized by field staff and external stocking proponents.

Material cited in this bibliography includes papers published in scientific journals, magazines and periodicals as well as "gray" literature such as file reports from Ontario Ministry of Natural Resources (OMNR) field offices. Unpublished literature was obtained by soliciting information (i.e., unpublished data and file reports) from field biologists across Ontario. Most published information was obtained from a literature search from the OMNR corporate library in Peterborough. Twenty-one major fisheries journals were reviewed as part of this exercise. These included Aquaculture (1972-1998), California Fish and Game (1917-1999), Copeia (1913-1999), Environmental Biology of Fishes (1976-1999), Fishery Bulletin (1963-1999), Fisheries Management (1975-1984), Journal of Freshwater Ecology (1981-1999), New York Fish and Game Journal (1954-1985), North American Journal of Fisheries Management (1981-1999), Journal of the Fisheries Research Board of Canada/Canadian Journal of Fisheries and Aquatic Sciences (1950-1999), Progressive Fish Culturist (1940-1999), and Transactions of the American Fisheries Society (1929-1999). Searches were also made of other publications including Proceedings of the Annual Meeting of the Southeastern Association of Fish and Wildlife Agencies, Proceedings of the Annual Meeting of the Western Association of Fish and Wildlife Agencies, Transactions of the North American Fish and Wildlife Conference, Transactions of the Annual Midwest Fish and Wildlife Conference, United States Department of the Interior Fisheries Technical Papers, FAO Fisheries Technical Papers and Circulars, and reports published under the Canadian Technical Report Series of Fisheries and Aquatic Sciences. Some material was obtained by a search on the Fish and Fisheries Worldwide database (1971-present) via the Internet. We also reviewed the personal collection of lake trout papers of the late Nigel (Nick) Martin which was donated to the OMNR library in Peterborough.

Information from over 440 sources has been assembled. Abstracts from published papers have been included wherever possible. In cases where abstracts were not available, an attempt has been made to extract pertinent material from the document to provide a synopsis of the findings. Where we were unable to obtain a copy of the document we have simply included the citation.

Table of Contents

Preface ..... (i)

Table of Contents ..... (ii)

History of Lake Trout Stocking in Ontario Inland Lakes 1

Synthesis of Selected Literature 5
  - Survival of Stocked Lake Trout 5
  - Contributions of Stocked Lake Trout to the Fishery 5
  - Contributions of Stocked Lake Trout to Spawning Stocks 6
  - Factors Influencing Stocking Success 6
  - Lake Trout Introductions 13
  - Impacts of Lake Trout Stocking 14
  - Best Management Practices for Lake Trout Stocking 14
  - Stocking Assessment 16

Annotated Bibliography 17

Acknowledgements 169

Subject Key 171

Subject Index 173

Appendix 1. Lake trout stocking in Ontario inland waters, 1880-1999.

Appendix 2. Introductions of lake trout in Ontario waters which have established self-sustaining populations.

Appendix 3. Contribution of stocked lake trout to selected recreational fisheries.

Appendix 4. Contribution of hatchery-reared lake trout to spawning stocks in selected waters.

History of Lake Trout Stocking in Ontario Inland Lakes

The earliest fish culture activities involving lake trout were those of the federal government of Canada which established several hatcheries across the country. The first of these was the Newcastle facility, Durham County, operated by Samuel Wilmot. This hatchery was constructed in 1868 and operated until 1914. The Newcastle facility was originally constructed to rear Atlantic salmon, but was soon adapted to raise other species of fish including brook trout and lake trout. It is believed that lake trout reared at this facility were derived from eggs collected annually at Colpoys Bay, Lake Huron. Lake trout reared at this facility were stocked as fry in the Great Lakes, Lakes Simcoe and Couchiching, and inland lakes of southcentral Ontario.

A second federally operated hatchery in Ottawa, which also reared lake trout, commenced production in 1890. Utilizing lake trout eggs transferred from the Newcastle facility, lake trout fry were produced for stocking primarily in eastern Ontario and western Quebec. This facility operated from 1890 to 1911.

Although lake trout were first propagated in Canada as early as 1868, one of the first references to lake trout culture in Ontario was in 1877 when 1,000,000 eggs were collected and incubated at the Newcastle facility. In 1880, some 40,000 lake trout fry were stocked in Lake Simcoe (McCrimmon 1956). By 1884 a total of 5,150,000 fry were distributed from the Newcastle facility. Some of the waters stocked during this period are summarized in Table 1.

Table 1. Early lake trout plantings in selected Ontario waters.

Lake (County)	Year Lake Trout First Stocked	Number Fish Stocked	Reference
Big Rideau (Leeds and Lanark)	1890	380,000 fry	MacLean and Hooper (1981)
Brule (Frontenac)	1900	40,000 fry	Anonymous (1901)
Charleston (Leeds)	1888	75,000 fry	MacLean and Hooper (1981)
Couchiching (Simcoe and Ontario)	1888	100,000 fry	Anonymous (1889$_a$)
Crowe Bay (Northumberland)	1880	100,000 fry	Anonymous (1965$_b$)
Devil's (Haliburton)	1880	50,000 fry	Anonymous (1965$_b$)
Eagle (Hastings)	1887	25,000 fry	Wilmot (1888)
Fairy (Muskoka)	1889	50,000 fry	Anonymous (1890)
Gillies (Bruce)	1892	Unknown (eggs)	Kerr (1983)
Joseph (Muskoka and Parry Sound)	1891	200,000 fry	Anonymous (1892)
Kushog (Haliburton)	1887	25,000 fry	Wilmot (1888)
L'Amable (Hastings)	1887	25,000 fry	Wilmot (1888)
Peninsula (Muskoka)	1889	50,000 fry	Anonymous (1890)
Redstone (Haliburton)	1887	50,000 fry	Wilmot (1888)
Rosseau (Muskoka and Parry Sound)	1889	100,000 fry	Anonymous (1890)
Sharbot (Frontenac)	1891	120,000 fry	Wilmot (1892)
Simcoe (Ontario, York and Simcoe)	1880	Unknown	McCrimmon (1956), McCrimmon and Skobe (1970)
Stoco (Hastings)	1884	100,000 fry	Anonymous (1885)
Stoney (Peterborough)	1880	Unknown	Anonymous (1965$_b$)

Early lake trout stocking practices were relatively indiscriminate. "Fry were distributed (particularly the young salmon (lake) trout) in almost every county of Ontario where waters were of sufficient magnitude and proper adaptation for their development" (Anonymous 1885). There are many examples (e.g., Kawartha lakes, private ponds, portions of the Trent and Severn Rivers, the Welland Canal, and many shallow, warmwater lakes) of lake trout being stocked in waters which were completely unsuitable for their survival.

In the 1920s, several federal hatcheries were transferred to the Province of Ontario and a fish culture branch was established within the Ontario Game and Fisheries Department. The large scale culture and release of lake trout eyed eggs and fry was continued. These early fish culture efforts by both the federal and provincial governments were directed primarily at commercial species, such as lake trout and lake whitefish, in the belief that artificial propagation was the solution to replenishing overexploited fish stocks. There was not the slightest evidence that any eyed egg or fry plantings had any effect other than in some cases of introductions (Lambert and Pross 1967). However, lake trout stocking programs have resulted in over 200 successful introductions of lake trout to Ontario waters (OMNR 1989).

By the 1930s more emphasis was placed on the culture of lake trout to the fingerling stage and by the late 1950s-early 1960s, yearling lake trout were the most commonly reared life stage being stocked in inland waters (see Appendix 1).

Today, between 8½-9 million fish are produced in provincial fish culture stations across the province (Table 2). Although eleven different species are reared, lake trout account for over half of the production by provincial fish culture stations.

Table 2. Fish stocked in Ontario waters from provincial fish culture stations in 1999.

Fish Species	Inland waters	Great Lakes	Total (% of total)
Atlantic salmon	0	212,014	212,014 (2.4%)
Aurora trout	40,038	0	40,038 (0.5%)
Brook trout	1,709,024	0	1,709,024 (19.3%)
Brown trout	101,498	198,281	299,779 (3.3%)
Chinook salmon	0	398,201	398,201 (4.5%)
Coho salmon	0	134,898	134,898 (1.5%)
F_1 splake	797,588	0	797,588 (9.0%)
Lake trout	**1,145,162**	**3,459,710**	**4,604,872 (51.9%)**
Lake whitefish	188,068	0	188,068 (2.1%)
Rainbow trout	249,138	155,654	404,792 (4.5%)
Walleye	79,248	5,650	84,898 (1.0%)
Total	4,309,764 (48.6%)	4,564,408 (51.4%)	8,874,172 (100.0%)

Of the 4.6 million lake trout reared in 1999, approximately three-quarters were earmarked for the Great Lakes while the remainder (1,145,162 fish) were stocked in inland waters. Lake trout were distributed in waters of eighteen OMNR districts across the province (Table 3).

Historically, the majority of lake trout stocking has been conducted to supplement resident populations of lake trout to maintain or enhance the recreational fishery. In 1990, almost four hundred lakes containing resident lake trout populations were stocked on a supplemental basis (OMNR 1989). In recent years, there has been a shift away from this practice as managers have become more aware of the negative impacts of planting hatchery-reared fish over an existing population.

Table 3. Lake trout stocking in Ontario waters by the Ontario Ministry of Natural Resources in 1999.

Region	MNR District	Number of Fish Stocked
Southcentral	Aurora	116,125
	Bancroft	39,479
	Kemptville	50,000
	Midhurst	2,100
	Parry Sound	38,525
	Pembroke	144,639
	Peterborough	93,930
Northeastern	Chapleau	32,500
	Cochrane	113,700
	Hearst	25,200
	Kirkland Lake	42,900
	North Bay	43,850
	Sault Ste. Marie	17,034
	Sudbury	205,528
	Timmins	83,100
	Wawa	10,052
Northwestern	Nipigon	46,600
	Thunder Bay	39,900
Total		1,145,162

Lake trout continue to be an important and highly sought fish in Ontario. Future inland stocking programs will focus on restoring depleted stocks (e.g., Sudbury basin) and providing put-grow-take angling opportunities.

Synthesis of Selected Literature

This section will attempt to summarize and highlight selected lake trout stocking related topics under the following categories:

1. Survival of stocked lake trout
2. Contribution of stocked lake trout to the fishery
3. Contributions of stocked lake trout to spawning stocks
4. Factors influencing stocking success
5. Lake trout introductions
6. Impacts of lake trout stocking
7. Best management practices for lake trout stocking
8. Stocking assessment

Survival of Stocked Lake Trout

Mortality rates in lake trout vary considerably among different stocks depending largely on the level of exploitation and presence of predators, such as sea lamprey. Generally, natural populations with total mortality rates exceeding 50% are in a state of decline.

There are relatively few well documented studies which provide detailed estimates of the survival of hatchery-reared lake trout after their release in the wild.

In Lake Manitou, Budd et al. (1968) estimated that the mean annual mortality rate of lake trout, stocked as yearlings, approximated 25%. Michigan stocking policies are based on the assumption that 20% of lake trout stocked as yearlings will survive and be returned to the fishery (Michigan Department of Natural Resources 1987). In Raquette Lake, New York, Shupp (1973) reported a 35.7% mortality rate of stocked fish between 1968 and 1969. In Cayuga Lake, New York, Webster (1959$_a$) estimated the annual survival rate of stocked lake trout at 46%. Annual mortality rates of 50% have been reported from the Twin Lakes, Colorado (Griest 1977) and Lake Opeongo, Ontario (Martin and Fry 1972).

Most mortality of hatchery-reared trout is believed to occur shortly after the stocking event (Siensennop 1992). There is also evidence that stocked lake trout have a higher mortality rate than wild lake trout (Hoyle and MacLean 1988, Hoyle 1990).

Contributions of Stocked Lake Trout to the Fishery

There are many instances where stocked lake trout make substantial contributions to a sport fishery (see Appendix 3). The lake trout fisheries in some lakes (e.g., Bernard, Deer, Hungry, Muskoka, Manitou, and Simcoe) are supported almost solely by hatchery-reared fish.

In many lakes which have been stocked, on a supplemental basis, stocked lake trout can account for 40-60% of the annual harvest. Finally, in other lakes, stocked lake trout make only a marginal contribution (e.g., <10%) to the fishery.

Contributions of Stocked Lake Trout to Spawning Stocks

In many instances, lake trout are stocked not only to provide angling opportunities, but also to contribute to natural recruitment. Introductions of hatchery-reared lake trout have served to establish self-sustaining lake trout populations in several Ontario lakes (see Appendix 2).

Spawning activity of both stocked and native lake trout has been observed in some situations (Liimatainen et al. 1987), but many biologists believe that native trout are more likely to contribute to local spawning populations than hatchery-reared fish. Hoyle (1990) reported that stocked lake trout (non-native strains) provided little or no contribution to the spawning population of several southeastern Ontario lakes which supported significant natural reproduction. Similar observations have been reported in other Ontario lakes which had native lake trout populations supplemented by stocking (Kerr 1981_a, Perron 1984, Dosser 1989).

There are other instances (e.g., Lake Manitou, Lake Simcoe, Lake Muskoka) where hatchery-reared lake trout account for virtually the entire spawning population (Amtstaetter 1999_b, Henderson 1982, Flowers 1984). Hatchery-reared lake trout have demonstrated their ability to spawn successfully. Hitchins and Samis (1986) identified successful reproduction of lake trout introduced in ten northeastern Ontario lakes. Similarly, the introduction of a Lake Superior strain of lake trout was successful in establishing self-sustaining lake trout populations in the Mishibishu chain of lakes in northern Ontario (Harrison 1969, 1970). Most reports of where hatchery-reared lake trout made a substantial contribution to the spawning population occurred in waters whose resident (native) lake trout populations are either depressed or extirpated.

In some lakes there may be additional factors involved with the poor contribution of stocked lake trout to spawning stocks and subsequent recruitment. The failure of stocked fish to reproduce naturally in Green Lake, Wisconsin, was attributed to a lack of cover on the spawning shoals which prevented egg predation. In several Minnesota lakes, Siesennop (1992) concluded that, at existing levels of angling intensity, most stocked lake trout were harvested within 2-3 years after stocking, thereby leaving few fish with the opportunity to mature and contribute to spawning stocks.

Factors Influencing Stocking Success

As with other species, there are a large number of factors which ultimately determine the success of a stocking project (Table 4).

Habitat Suitability - Lake trout have very stringent habitat requirements (see Table 5) and the availability of suitable year-round habitat may be the most common reason for the failure of many lake trout stocking projects. The two most critical parameters are water temperature and dissolved oxygen. Lake trout prefer water temperatures between 8-15° C and dissolved oxygen levels exceeding 5 mg L^{-1}. During some periods of the year (e.g., mid-late summer and late winter) these parameters may limit lake trout distribution and abundance. Shoreline development and associated nutrient loadings are often associated with this problem. Lake trout also prefer deep, clear water and seem better suited to large lakes. Siesennop (1992) suggested that stocked lake trout may be less affected by predators and other competitors in larger lakes as compared

Table 4. A summary of potential factors which can influence the success of a lake trout stocking project.

Factor	Reference(s)
Poor habitat and/or water quality	Anonymous (Undated$_d$, Undated$_g$, 1987$_b$, 1990), Odell and Senning (1937), Jacob (1964), Charlton (1967), Marshall and Johnson (1971), Auclair (1976), Eckersley and McIntosh (1976), Wilton (1978), Wright and Sopuck (1979), Chapple (1981$_b$, 1984$_b$), Liimatainen (1983), Sly and Widmer (1984), Jensen and Chen (1986), Gunn et al. (1987), Siesennop (1992)
Age/size of fish when stocked	Anonymous (1970), Maine Department of Inland Fish and Wildlife (2000)
Fish health and condition	Siesennop (1992), Wootten (1997)
Handling/transport stress	Black (1955), Robinson (1990), McDonald et al. (1993)
Stocking technique	Anonymous (1951)
Interspecific competition	Anonymous (Undated$_d$), McMurtry (Undated), McAfee (1966), Eckersley and McIntosh (1976), Hutchinson (1981), Chapple (1981$_b$) (1982$_a$)Powell et al. (1986), Gunn et al. (1987), Livingstone (1990), Prydie (1991), Thomas (1994), Maine Department of Inland Fish and Wildlife (2000),
Intraspecific competition	Anonymous (1953) (1959), McAfee (1966), Harrison (1969), Purych (1977$_a$), Hamilton (1979), Loftus (1985), Powell et al. (1986), Gunn et al. (1987), Hoyle (1990)
Predation	McMurtry (Undated), Shetter (1952), Purych (1977$_a$), Siesennop (1992), Noakes and Curry (1995), Maine Department of Inland Fish and Wildlife (2000),
Genetic strain	McDonald and Wood (Undated), Haskell (1952), Haskell et al. (1952), Webster (1959$_b$), Anonymous (1971), MacLean et al. (1981), Kapuscinski and Jacobson (1987), McDonald and Robinson (1993)
Forage availability	McAfee (1966), Minnesota Department of Natural Resources (1982), Maine Department of Inland Fish and Wildlife (2000)

Table 5. Basic habitat requirements of lake trout.

Parameter	Requirement
Lake size	• Larger lakes (e.g., > 100 ha)
Maximum depth	• At least 40-45 feet (12-14 m)
Mean depth	• Greater than 20-30 feet (6.1-9.2 m)
Littoral area	• Less than 50%
Morphoedaphic index (MEI)	• < 3
Water temperature	• 8-15° C preferred
Dissolved oxygen	• > 5 mg L^{-1}
Water clarity	• Secchi depth > 5.2 m
Alkalinity	• < 80 mg L^{-1}
Total dissolved solids	• < 50 mg L^{-1} preferred
pH	• > 5.5

to smaller lakes. Water level fluctuations, whether natural or artificial, and the absence of suitable spawning facilities may preclude successful spawning of stocked lake trout.

Age/Size of Fish Stocked - Initial lake trout stocking programs involved early life stages of trout (e.g., eggs and fry) but it soon became apparent that stocking success could be improved by the culture and release of larger, older life stages.

Several researchers have made recommendations in terms of the size of fish which provide optimal survival and return (Table 6).

Table 6. Optimal sizes of lake trout to stock based on a review of stocking assessment literature.

Size of Fish	Reference(s)
≥ 20 cm in length	Machniak (1975)
20-25 cm in length	Mutenia et al. (1982)
6-8 inch (15-20 cm) in length	Maine Department of Inland Fish and Wildlife (2000)
5-7 inch (13-18 cm) in length	Michigan Department of Natural Resources (1987)
20 fish/lb (49 fish/kg)	Olver (1973)
17-20 fish/lb (42-49 fish/kg)	OFAH (1986)
15-19 fish/lb (37-47 fish/kg)	Schuler (1969)
18 fish/lb (44 fish/kg)	Québec Ministère du Loisir, de la Chasse et de la Pêche (1988)
Fingerlings - 50-75 fish/lb (124-185 fish/kg)	Minnesota Department of Natural Resources (1982)
Yearlings - 15-20 fish/lb (37-49 fish/kg)	

Fry or fingerlings are best suited to stock in lakes which are either barren or contain only forage fish species. There are few reports of stocking assessment where fry have been planted. After three years of stocking lake trout fry in a northern Ontario lake, Sadowsky (1998) concluded that post-stocking survival was negligible and that the stocking program would be altered to use yearling trout. The only annual stocking of lake trout eyed eggs and/or fry involves a small number of lakes in northeastern Ontario. The remainder of lake trout stocked inland at this life stage represent surplus production from provincial fish culture stations.

Several studies have demonstrated the benefits of stocking yearling versus fingerling lake trout. Webster (1958) reported that yearling lake trout, planted at a size of 5 inches in April, survived four times as well as fingerlings planted in September at 3$^{1}/_{2}$ inches in length. Plosila (1977$_{a}$) found that lake trout stocked as spring yearlings outperformed fish released as fall fingerlings in nine northern New York lakes. The overall survival ratio was 1 fall fingerling : 9.5 spring yearlings : 8.7 fall yearlings. In Little Ossipee Lake, Maine, spring stocked yearlings outnumbered those stocked as fall fingerlings by a factor of 17:1 (Anderson 1962). Greene (1955) reported that comparative recoveries of lake trout stocked as yearlings outnumbered those released as fingerlings by a ration of 6.6:1. Based on a comparative evaluation of fingerling and yearling introductions of lake trout in Pallette Lake, Hoff and Newman (1995) recommended that spring yearling lake trout be stocked instead of fall fingerlings in inland Wisconsin lakes. After a review of lake trout introductions in Sweden, Machniak (1975) reported that the survival of fish planted as young-of-the-year was low; survival was good for trout planted as two year olds; and intermediate for yearling releases. In Cayuga Lake, lake trout stocked as two year old fish showed the greatest proportionate return followed by fish aged 1 1/2 years and yearlings. Trout stocked as fingerlings had the poorest return of all age groups.

Fish Health and Condition - The health and condition status of the hatchery-reared product is obviously an important variable which could determine post-stocking survival. In addition to stocking a healthy product, care must be taken not to introduce any disease or parasite into a new ecosystem. There is speculation that the demise of cutthroat trout in Lake Tahoe was caused by an epizootic carried by lake trout (La Rivers 1962). Generally, improved fish culture practices and rigorous fish health standards have reduced the importance of this factor in recent years and there are very few instances where fish health has been identified as a factor in poor stocking success in inland lakes.

Handling and Transport Stress - Physiological changes induced by stresses of handling and transport can result in delayed mortality of stocked lake trout. Common handling and transportation practices are known to lead to the accumulation of lactic acid and the loss of ions in hatchery-reared lake trout immediately prior to stocking. There are also implications of transferring trout between hard and softwater sources. These factors can result either in immediate or delayed mortality.

Stocking Technique - Stocking technique includes variables such as frequency of stocking, stocking rate, time of stocking (season and time of day), selection of release sites and method of distribution.

Lake trout stocking programs have traditionally been conducted on an annual basis in many Ontario lakes. There seems to be increased recognition that, with the possible exception of fingerling stocking, yearling releases are probably only required on an alternate year basis. MacIntosh and Eckersley (1976_a) concluded that small (1,000 yearling fish) plantings of lake trout every 2-3 years would maintain the fishery of Lower Raven Lake, Ontario. Bradbury (1979) recommended continuation of lake trout stocking in several Algonquin area lakes at three year intervals. Both the state of Minnesota (Minnesota Department of Natural Resources 1982) and the Province of Québec (Québec Ministère du Loisir, de la Chasse et de la Pêche 1988) recommend yearling lake trout stocking be conducted every 2-3 years instead of on an annual basis.

Stocking rates utilized by various jurisdictions (Table 7) are usually based on the age of the fish and consideration of the amount of suitable deepwater habitat.

Pellegrini (1992) found that stocking at elevated levels (up to 61.7 yearling trout per hectare) did not improve returns in Wawa Lake, Ontario. Barnes et al. (1984) found that there was no relationship between stocking rate and year class strength in five southeastern Ontario lake trout lakes.

Casselman (1986) concluded many lakes were overstocked at currently lake trout stocking rates and suggested that stocking densities of juvenile lake trout be based on the preferred density of fish in the profundal nursery area and the amount of deepwater nursery habitat available.

Table 7. Lake trout stocking rates utilized in various North American jurisdictions.

Waterbody	Stocking Density	Reference
Maine waters	• 5 spring yearlings per surface acre of water between 40-100 feet(12-30 m) in depth	Maine Department of Inland Fish and Wildlife (2000)
Michigan waters	• 2-25 yearlings per surface acre	Michigan Department of Natural Resources (1987)
Minnesota waters	• 10-20 fingerlings per surface acre • 5-10 yearlings per surface acre	Minnesota Department of Natural Resources (1982)
New York waters	• $30\sqrt{MEI}$ fingerlings per acre • $15\sqrt{MEI}$ yearlings per acre	New York Department of Environmental Conservation (1979)
Ontario waters	• MEI (metric)> 3.3 - 0.4 kg yearling lake trout per ha between 15-46 m in depth • MEI (metric)<3.3 - 0.2 kg yearling lake trout per ha between 15-46 m in depth	Ontario Ministry of Natural Resources (1982)
	• Annually at 0.1 kg yearling fish/ha surface area • Alternate years at 0.2 kg yearling fish/ha surface area	Ontario Ministry of Natural Resources (2000_b)
Québec waters	• 5-24 yearlings per ha of summer habitat • 50-240 fingerlings per ha of summer habitat	Québec Ministère du Loisir de la Chasse et de la Pêche (1988)

McMurtry (Undated) concluded that the season of stocking (spring vs. fall) had no significant effect on the survival of stocked lake trout in low and moderate alkalinity lakes. Although most yearling lake trout are released in the spring shortly after ice-out, there is some evidence that stocking hatchery-reared trout through the ice may not be a sound practice. Pellegrini (1992) attributed poor returns of stocked lake trout partially due to the fact that the fish were stocked through the ice in late winter-early spring.

In some locations, high losses of hatchery-reared trout are attributed to predation by avian predators such as seagulls. In these situations, releases at night may alleviate this problem.

Release sites in the past have traditionally been over shallow shoals or at a readily accessible shoreline site. Care should be taken to ensure that the stocking site is relatively predator-free and close to preferred nursery habitat.

The poor success of early lake trout fry plantings in Rideau Lake was attributed to the fact that they were released in shallow littoral areas having an abundance of predators and no cover (Anonymous 1951). Bean (1916) recommended that lake trout fry should be stocked over rocky shoals and reefs in close proximity to deep water. Eaton (1928) concluded that plantings of fingerling lake trout in the Finger Lakes of New York should be done in waters exceeding 60 feet (18.3 m) in depth and well scattered during release. Similarly, Plosila (1977_a) believed that spot or scatter plantings over deepwater areas by airplane or boat was more preferred than stocking in inshore areas. That practice is also recommended in the State of Maine (Maine Department of Inland Fish and Wildlife 2000). In Ontario, Casselman (1986) recommended that the current practice of stocking yearling lake trout over traditional spawning shoals be altered so that these fish were instead released over deep water in order that they may quickly access their preferred juvenile habitat.

Interspecific Competition - Interspecific competition is the interaction that occurs between two or more species that share some environmental resource (e.g., food or habitat) which is in short supply. Interspecific competition has been identified as a factor influencing the success of lake trout stocking projects in several instances (Anonymous Undated_d, McMurtry Undated, Hutchinson 1981, Gunn et al. 1987, Maine Department of Inland Fish and Wildlife 2000,). Species which are known to compete for resources with lake trout include walleye (Chapple 1981b), lake herring (Eckersley and MacIntosh 1976, Chapple 1982_a, Powell et al. 1986, Livingstone 1990, Prydie 1991, Gunn and Mills 1998,), lake whitefish (Powell et al. 1986, Livingstone 1990), burbot (Eckersley and McIntosh 1976), smelt (Thomas 1994) and other salmonids (McAfee 1966).

Intraspecific Competition - Intraspecific competition is the interaction between two members of the same species. There are many examples (Table 8) where supplemental stocking over a resident, naturally reproducing population have produced very poor returns. In many cases such stocking practices have been discontinued.

Table 8. Examples of some Ontario lakes where supplemental lake trout stocking has proven unsuccessful.

Lake	Reference(s)
Basswood	Purych (1973)
Boshkung	McLeish (1991)
Buck	Chapple (1983_b)
Devil	Hoyle and MacLean (1988), Hoyle (1990)
Flack	Olver (1972_a), Purych (1976_b, 1977_a, 1977_b)
Jimchrist	Purych (1973)
Lake of Bays	GS Environmental Service (2000)
Nipigon	Gibson (1968)
Opeongo	Anonymous (1953, 1959)
Redpine	MacDonald and Hartley (1988)
Semiwite	Olver (1971_f)
Temagami	Jorgensen (1971, 1973_b)
Wawa	Kerr (1981_b), Pellegrini (1992)

Generally, stocked lake trout perform poorly when in competition with native lake trout and returns of stocked trout are best in lakes where native lake trout are either absent of severely depressed (Loftus 1985, Hoyle 1990). Intraspecific interactions appear to be largely density dependent. Powell et al. (1986) concluded that the survival of stocked trout was negatively influenced by the size of the native lake trout population. In Mishibishu Lake, Ontario, Harrison (1969) found that the rate of maturation of stocked fish was directly related to the abundance of older lake trout in the population.

Currently, supplemental stocking practices in Ontario waters already supporting a viable, self-sustaining lake trout population are being discontinued.

Predation - Predation on stocked fish is a common problem for many hatchery-reared fish including lake trout. Most predation occurs on younger life stages since adult lake trout have relatively few predators. Since juvenile lake trout inhabit deep waters, most predation originates from other fish species including walleye (Nevin 1892), lake trout (Purych 1970, Siesennop 1992), yellow perch (Van Wyck 1957, McIntosh and Eckersley 1976_a), and alewife (Krueger and Shepherd 1997).

Genetic Strain - Genetic strain of hatchery-reared lake trout has been recognized as important in determining fitness, response to stress, growth, maturation, catchability, and post-stocking survival. Several studies have confirmed the importance of selecting the most appropriate genetic strain of lake trout for a particular stocking project. In a New York study involving nine lakes, the Upper Saranac Lake strain comprised 94.3% of lake trout recoveries while the Seneca strain constituted 5.7% of the recoveries. In four northeastern Minnesota lakes stocked with three different strains of lake trout, one strain (Gillis Lake) outperformed the other two strains (Isle Royale and Marquette) which were also stocked. Plosila (1977_a) concluded that strain was more important than size of fish or season of stocking in determining post-stocking survival.

The importance of genetic considerations is evident by the fact that there are presently twelve different lake trout strains in the provincial fish culture system.

Forage Availability - The availability of suitable forage has been identified as a factor influencing stocking success. In several instances, forage species, such as lake herring, have been introduced when it became apparent that adequate forage was not available to support stocked lake trout.

Lake trout are omnivorous (Table 9). Young lake trout feed primarily on invertebrates and aquatic insects. Older trout are primarily piscivorous.

Table 9. Food items of stocked lake trout in inland lakes.

Food Item	Reference(s)
Zooplankton/invertebrates	Anonymous (Undated$_j$), Hacker (1957, 1962), Nilsson and Svardson (1968), Youngs and Ogelsby (1972), Machniak (1975), Griest (1977), Soldwedel (1978), Loftus (1982), Gönczi and Nilsson (1983), Moore (1984)
Aquatic insects	Purych (1973, 1976_a), Griest (1977), Loftus (1982), Anonymous (1983), Moore (1984),
Crayfish	Purych (1976_a)
Fish	
Alewife	Schuler (1969), Youngs and Oglesby (1972), Moore (1984)
American smelt	Nilsson and Svardson (1968), Schuler (1969), Machniak (1975), McIntosh and Eckersley (1976_c), Swainson (1980), Loftus and Rubic (1982), Gönczi and Nilsson (1983), Lauer (1983)
Arctic charr	Göczi and Nilsson (1983)
Brook stickleback	Moore (1984)

……cont'd

Table 9 (cont'd)

Food Item	Reference(s)
Cyprinids	Loftus (1982), Moore (1984)
Lake herring	Hacker (1957), Machniak (1975), Gönczi and Nilsson (1983), Moore (1984), Loftus (1985)
Lake whitefish	Gerlach (1967), Nilsson and Svardson (1968), Machniak (1975), Mutenia et al. (1982), Gönczi and Nilsson (1983)
Pumpkinseed	McIntosh and Eckersley (1976_c)
Rainbow trout	Griest (1977)
Sculpins	Youngs and Ogelsby (1972)
Smallmouth bass	Loftus (1982), Loftus and Rubie (1982)
Trout-perch	Youngs and Oglesby (1972)
White sucker	Griest (1977)
Yellow perch	Chalk and Stockes (1978_b), Nilsson and Svardson (1968)
Misc. (plant material, rocks)	Moore (1984)

Lake Trout Introductions

Hatchery-reared lake trout have demonstrated the ability to colonize a new environment particularly waters providing preferred habitat conditions and a relatively simple fish community. Lake trout have been successfully introduced into almost 70 Ontario lakes (Martin and Olver 1976, OMNR 1989) and several United States lakes including Lake Tahoe, Nevada Lake and Lewis Lake (Krueger and May 1991). Several attempts have been made to introduce lake trout in Scandinavia (Nilsson and Svardson 1968, Mutenia et al. 1982, Gönczi and Nilsson,1983), Europe (Crossman 1995), South America (Welcomme 1988) and New Zealand (Welcomme 1988) but few have been successful in establishing self-sustaining populations. Crossman (1995) reported that, of thirteen attempts outside North America, only four have established self-sustaining populations.

Based on a review of 185 lake trout introductions, Evans and Olver (1995) identified factors which contributed to successful colonization. These and other observations are summarized in Table 10.

Table 10. Factors contributing to successful colonization of lake trout

Factor	Conditions	Reference(s)
Genetic origin	• matched to recipient waterbody	Olver and Lewis (1977)
Exploitation	• light if any (harvest controls implemented)	Crossman (1995), Evans and Olver (1995), Schraeder (1983)
Size of lake	• best in larger lakes	Evans and Olver (1995)
Environmental parameters	• suited to lake trout	Crossman (1995)
Predation and competition	• low (simple fish communities)	Crossman (1995), Evans and Olver (1995)
Forage availability	• preferred forage abundant	Gönczi and Nilsson (1983)
Total dissolved solids (TDS)	• low	Evans and Olver (1995)
Littoral zone	• small	Evans and Olver (1995)
Hypolimnion	• large	Mutenia et al. (1982), Evans and Olver (1995)

Impacts of Lake Trout Stocking

There are a number of potential impacts which could arise from the introduction of lake trout (see Table 11 and Kerr and Grant 2000). While the introduction of lake trout has been blamed for the demise of some native fish species including bull trout, cutthroat trout, and Sunapee trout (Fuller et al. 1999), probably the greatest impacts arise when hatchery-reared lake trout are stocked over resident populations of lake trout. Supplemental lake trout stocking can contribute to the loss of native stocks. Stocked juvenile lake trout have been observed to eat lake trout eggs (Liimatainen et al. 1987). Increased angling pressure resulting from angler expectations from a lake trout stocking program can lead to the overharvest of resident (wild) lake trout stocks. Genetic introgression between wild and hatchery-reared stocks can have effects on performance traits of resident lake trout. There is also evidence that artificial increases in lake trout abundance arising from stocking programs can reduce natural recruitment. In two southcentral Ontario lakes, cessation of supplemental stocking activities was followed by an increase in natural recruitment (Dunlop and Brady 1995, 1997). The increase in natural reproduction was attributed to reduced competition with stocked trout.

Table 11. Potential impacts of lake trout stocking on resident biota.

Impact	Reference(s)
Displacement/loss of native lake trout	American Fisheries Society (Undated), Evans et al. (1991), Evans and Willox (1991), Evans (1992)
Hybridization/genetic introgression	Marnell (1986), Hindar et al. (1991), Leary et al. (1995)
Displacement/loss of other species	Marnell (1986), Fuller et al. (1999)
Competition for food	Marnell (1986), Kerr and Grant (2000)
Predation	Marnell (1986), Liimatainen et al. (1987), Kerr and Grant (2000)
Introduction of diseases/parasites	La Rivers (1962), Marnell (1986), Kerr and Grant (2000)
Increased angling pressure	Ontario Ministries of the Environment and Natural Resources (1993)

Best Management Practices for Lake Trout Stocking

Based on a review of the available literature, several best management practices can be presented for future lake trout stocking activities.

> **Establish Stocking Objectives** - It is imperative that the objectives of lake trout stocking projects be clearly defined with quantified measures for determining stocking success.

Selection of Genetic Strain - Care should be taken to ensure a match, as closely as possible, of the characteristics of the hatchery strain of lake trout and the environment into which they will be released. Some characteristics to consider include water source (e.g., hard vs. soft), spawning characteristics, and forage preference (e.g., planktivorous vs. piscivorous).

Suitability of Waterbody - Lake trout have very specific habitat requirements and a complete updated lake inventory should be conducted before stocking is undertaken. Particular attention should be given to water temperatures and dissolved oxygen during the critical late summer and late winter period.

Fish Marking - All hatchery-reared lake trout should be marked in the most easily recognizable and cost-effective means when stocked in Ontario inland lakes. Marking should serve to differentiate native from hatchery-reared fish and provide some indication of age.

Fish Health - Extreme care should be taken to prevent the release of any seriously diseased fish into the wild. Fisheries managers should strive to stock fish in the best condition possible.

Lake Trout Introductions - A full environmental assessment, as defined by the Class Environmental Assessment for fish stocking in new waters, must be completed before any introduction of lake trout. It is highly recommended that the fishery be closed for several years on lakes where an introduction is underway.

Supplemental Lake Trout Stocking - Generally, supplemental stocking practices should be discontinued. To minimize impacts of stocking hatchery-reared lake trout over established lake trout populations, supplemental stocking of fish from a non-local source should not be conducted when a representative sample of trout indicate that more than 20-25% are native fish.

Handling and Transport -Stocking proponents should take all necessary precautions to reduce physiological symptoms of stress during handling, transport, and release of hatchery-reared lake trout.

Age/Size of Stocked Fish - The most cost-effective size and life stage of lake trout should be used based on the goal of the stocking project. For most stocking in Ontario this will involve the use of yearling fish at a size of approximately 20-30 grams.

Stocking Rates - There are many indications that stocking rates have been too high in the past. Stocking rates should account for the amount of summer habitat and simulate densities found in natural populations based on the carrying capacity of the habitat and forage base. Currently, stocking rates are in the order of 8-10 yearlings per surface hectare in small lakes and 4-5 yearlings per surface hectare in larger lakes. These rates need to be modified to reflect actual lake trout habitat.

Stocking Frequency - Depending on the objective, lake trout stocking should generally be conducted every 2-3 years on a particular waterbody. In some heavily fished waters, it may be necessary to stock fish on an annual basis.

Stocking Site - Lake trout should be released at sites where naturally produced trout would be at the same life stage. For yearling lake trout this would be offshore in areas of deep water or along shoals with immediate access to deep water. Juvenile trout are believed to disperse quickly into deep water nursery habitats. Care should be taken to avoid stocking off windward shorelines.

Stocking Technique - Lake trout should be stocked in the spring before surface waters reach 15° C (ideally 5-10° C). Efforts should be made to avoid a large temperature differential (e.g., < 5° C) between holding water and lake water. Fish should be stocked from an aircraft or boat and well dispersed over a large area.

Stocking Evaluation - An evaluation of the success of the stocking project should be undertaken on a representative sample of stocked waters. Success or failure should be based on the objectives which were established.

Stocking Assessment

The post-stocking evaluation of hatchery-reared trout should be considered an important component of any stocking project. Assessment is critical to know if original stocking objectives (e.g., returns to a fishery, natural reproduction, etc.) were met and, if not, what modifications to stocking practices are required.

Ideally, lake trout stocking assessment programs should be conducted by a standardized technique with results reported in a consistent fashion. For lakes being stocked to provide a fishery, creel surveys should be conducted based on provincial protocols (e.g., CREESYS). Information reported should include fishing effort directed at lake trout, lake trout catch-per-unit-of-effort (CUE), observed and estimated lake trout catches and harvests, and contribution (%) of hatchery-reared trout in the creel.

Netting projects also provide a quick and cost-effective means of evaluating post-stocking survival and growth. The State of Minnesota (Minnesota Department of Natural Resources 1982) recommends gill nets set (often suspended) in the range of preferred water temperatures (10-13° C) in the summer. Netting is conducted every 3-5 years on an individual water.

In Ontario, the basis for lake trout assessment is spring littoral index netting (SLIN). Sampling involves the use of gill nets (91.4 m of three mesh sizes: 38 mm, 51 mm and 64 mm) set during the daylight hours in the spring between ice melt and water temperatures of 13° C. Nets are set perpendicular from shore in depths ranging from 2.5 m to a maximum of 60 m. Each net is set for a period of 90 minutes before it is lifted. For field programs the recommended minimum number of sets per lake is 30 and the minimum number of sample days is 5. Reported information should include lake trout CUE, proportion of stocked versus native fish, and biological characteristics of sampled fish.

Annotated Bibliography

ALEXANDER, G. R. 1970. Trout biology and population ecology: Studies on mixed species of trout planted in unfished lakes. Michigan Department of Conservation. Ann Arbor, Michigan. 4 p.

ALLISON, L. N. 1963. Cataract in hatchery lake trout. Transactions of the American Fisheries Society 92 : 34-38.

In 1957, when control of the sea lamprey appeared imminent, production of lake trout (*Salvelinus namaycush*) in hatcheries was increased. Coincident with this increase, certain diseases of lake trout became evident. One disease, cataract, results in permanent damage to the eye. Several experiments to investigate the cause of cataract were conducted over a period of three years; 3 with diets, 3 involving light intensity, 1 involving handling and 1 experiment with injections of excess riboflavin. The experiments with diet, handling and riboflavin injections did not provide control of cataract.

AMERICAN FISHERIES SOCIETY. Undated. Minnesota Chapter position statement on fish stocking. www.fw.umn.edu/mnafs/fishstocking.pdf.

The transfer of fish from one body of water to another has probably occurred for as long as man has had vessels that could hold water. Fish stocking has been used as a management tool in Minnesota since the late 1800s. Minnesota, like many states, has a long and mixed history in regard to fish stocking with both sanctioned and unsanctioned stocking having occurred.

Today, factors such as genetic conservation, biodiversity, and inter- and intra-specific interactions are increasingly major components of stocking programs, be they for the re-introduction of an extirpated species or the enhancement of existing populations.

Supplemental stocking of lake trout, which has occurred in numerous lakes in northeastern Minnesota, may have contributed to the loss of native stocks. Genetic analysis revealed the presence of only the most recently stocked lake trout genotype in two native lake trout lakes in Voyageurs National Park that had been subjected to long term supplemental stocking.

To minimize the potential for negative effects, stocking done by government agencies and private industry must be conducted in accordance with the best available scientific and professional information. Effects of stocking on forage and non game fishes and other components of the aquatic community need to be seriously considered in all phases of any stocking program. Genetic conservation must be a high priority in all stocking programs, including private stockings. It is imperative that those aquatic habitats and native fish communities that remain unaltered be identified and preserved. Stocking needs to be part of a comprehensive fisheries management program, not a means unto itself. Also, stocking should not be viewed as a politically expedient alternative to ecosystem restoration and harvest management. Stocking programs must have explicit goals and objectives so that they can be objectively evaluated. To facilitate evaluation of stocking programs, all stocked fish should be marked.

AMTSTAETTER, F. 1999$_a$. Lake Simcoe lake trout stocking records, 1966-1999. File Records, Lake Simcoe Fisheries Assessment Unit, Ontario Ministry of Natural Resources. Sutton, Ontario. 3 p.

Annual stocking records for Lake Simcoe between 1966 and 1999 are presented. Annual stocking rates varied from 17,000 – 247,500 fish annually (34 year average of 154,214 fish per year). Fingerlings, yearlings and two-year old fish were stocked during that interval although plantings have consisted of yearling fish only since 1978. With the exception of 1967, all stocked fish were marked by a distinctive fin clip. Stocking sites included Big Bay Point, Eight Mile Point, Strawberry Island, Shanty Bay, Long Shoal, Kempenfelt Bay, Fox Island, North Georgiana Island, Sibbald Point, Jackson's Point, McGinnis Point, Oaklawn Beach, Bayshore Village, Big Shoal, Willow Beach and Hawkstone Dock.

AMTSTAETTER, F. 1999$_b$. Fall trapnetting on the spawning grounds of lake trout (*Salvelinus namaycush*), lake whitefish (*Coregonus clupeaformis*) and cisco (*C. artedii*) in Lake Simcoe, 1989-1997. Report 1991-1, Lake Simcoe Fisheries Assessment Unit, Ontario Ministry of Natural Resources. Sutton, Ontario. 36 p.

Fall netting on lake trout and lake whitefish spawning shoals has been conducted on Lake Simcoe on a recurrent basis since 1951. This report summarizes results from the fall netting program from 1989 to 1997 as well as some historical data for longer term analysis and includes recommendations for future programs. The proportion of lake trout caught on the spawning shoals that are of hatchery origin has increased from 89.5% in 1978 to 99.9% in 1997. The number of lake trout stocked from the 1965 to the 1996 year classes has varied from 6,050 (1969 year class) to 227,500 (1966 year class). Since 1981, the number stocked has varied from 90,000 to 100,000 per year.

ANDERSON, R. B. 1962. A comparison of returns from fall and spring stocked hatchery-reared lake trout in Maine. Transactions of the American Fisheries Society 91(4) : 425-427.

It is important that fish be stocked at the time and age that will provide maximum survival and return to fishermen. A study was undertaken to determine the difference, if any, between angler returns from spring-stocked and fall-stocked lake trout (*Salvelinus namaycush*) in Little Ossipee Lake, Maine.

All the lake trout used in this study originated from eggs taken from wild brood stock at Atikmeg Lake, Manitoba, Canada. All groups received the same care and were hatched and raised at the same hatchery. Lake trout were first introduced into Little Ossipee Lake in September 1955 and were stocked twice each year in 1956 and 1957. The total number released during the study was 120,000. Eighty-five thousand were fall-stocked fingerlings and 35,000 were spring-stocked yearlings. All fish released were marked by fin-clipping except for the 50,000 released in September 1955. The members of this group could be distinguished later by their size and age.

In partial creel censuses during February and March of 1959, 1960, 1961 and 1962, 422 lake trout were examined. Fish stocked in the spring outnumbered those that had been stocked in the fall by almost 17 to 1 in fishermen's creels. The 10,000 lake trout released as spring yearlings in June 1957 provided more than 62% of the fish creeled and constituted the most important part of the fishery in the four creel census years. The 25,000 lake trout released as fall fingerlings in September 1956 and the 10,000 released as fall fingerlings in September 1957 have provided no recaptures in the ice fishery. The 50,000 released in September 1955 provided the only returns of fall-stocked fish recorded during this study.

No cause of the variation in returns was established but the advisability of stocking hatchery-reared lake trout in the spring is apparent.

ANONYMOUS. Undated$_a$. L'Amable Lake fisheries assessment. File data. Ontario Ministry of Natural Resources. Bancroft, Ontario.

L'Amable Lake has been stocked with lake trout on a regular basis since 1923. The average stocking rate (1974-1985) has been 5,450 yearlings on an annual basis. There is a high degree of natural reproduction in the lake with between 6-9 spawning beds. Based on creel surveys, the contribution of stocked fish in the catch has varied from 38% (spring 1985) to 77% (winter 1984).

ANONYMOUS. Undated$_b$. Bay Lake fisheries assessment. File data. Ontario Ministry of Natural Resources. Bancroft, Ontario.

Bay Lake has been stocked with lake trout from the late 1930s to the present time. The average stocking rate (1975-1985) has been 3,1000 yearlings annually. There is a moderate amount of natural reproduction with six known active spawning beds. Based on creel surveys, the contribution of stocked lake trout to the catch has ranged from 17% (spring 1985) to 46% (summer 1986).

ANONYMOUS. Undated$_c$. Chandos Lake fisheries assessment. File data. Ontario Ministry of Natural Resources. Bancroft, Ontario.

Lake trout have been stocked in Chandos Lake from 1923 to the present time. The average stocking rate (1974-1985) has been 9,200 yearlings annually. There is a high degree of natural reproduction in Chandos Lake with at least 19 active spawning beds. Based on six different creel surveys, the contribution of hatchery-reared lake trout to the catch has ranged from 0% to 35%.

ANONYMOUS. Undated$_d$. Survival netting on Lake No. 24, Pearce Township. File Report. Ontario Ministry of Natural Resources. Kapuskasing, Ontario. 2 p.

Lake No. 24, Pearce Township was stocked in 1984 with 2,500 yearling lake trout and stocked again in 1985 with a further 2,000 yearling lake trout.

Netting was conducted on July 8, 10 and 11, 1985 to determine stocking success and growth rates before further stocking. A total of 41.0 hours of netting were conducted with a total catch of 56 northern pike. Fish were caught at depths of 1-12 meters.

During the netting exercise several schools of yellow perch were observed but none were captured. Also, several large schools of minnows were observed throughout the lake. Stomach content analysis of the northern pike also revealed no lake trout.

Due to the large number of northern pike captured and the lack of a suitable spawning site it is recommended that no further stocking take place.

ANONYMOUS. Undated$_e$. Quality control monitoring of hatchery-reared lake trout and whitefish destined for Lake Simcoe. Fish Culture Section, Ontario Ministry of Natural Resources. Toronto, Ontario. 26 p.

This report is intended to serve as an outline of the information requirements which would satisfy quality control monitoring of Lake Simcoe hatchery introductions. Information requirements are categorized in terms of fitness indicators, controlling and stocking factors. Fitness indices include size and condition, biomass, sex ratio, genetic fitness, disease, fin conditions and abnormalities. Controlling factors are those which may influence the fitness level of the hatchery-reared fish. They include a broad range of items from egg collection parameters through to the rearing conditions at the hatchery. Stocking factors are those which influence the well being of the fish and ultimately their survival that come into effect after the fish have left the hatchery environment. These factors include transportation conditions, handling and holding, planting procedures, and stocking location.

ANONYMOUS. Undated$_{f}$. Summer creel census data for Charleston Lake. Unpublished data. Rideau Lakes Fisheries Assessment Unit, Ontario Ministry of Natural Resources. Sharbot Lake, Ontario.

Summer creel census data for six years (1981, 1983, 1985, 1987, 1992, 1994) are summarized. The proportion of stocked lake trout in the catch was 48.3% in 1981, 50.6% in 1983, 67.7% in 1985, 43.8% in 1987, 52.5% in 1992 and 61.3% in 1994. Overall the mean proportion of stocked fish in the catch for these six years was 54.0%. The estimated harvest of stocked lake trout in the summer fishery ranged from 2,474 fish in 1992 to a high of 6,282 in 1985.The estimated yield (kg/ha) of stocked fish varied from 0.91 in 1981 to 2.36 in 1994.

Winter creel census data for six years (1981, 1982, 1983, 1984, 1985, 1986) are summarized. The proportion of stocked lake trout in the catch was 55.6% in 1981, 50.0% in 1982, 56.0% in 1983, 68.2% in 1984, 68.9% in 1985 and 52.0% in 1986. Overall the mean proportion of stocked fish in the winter catch for these six years was 58.4%. The estimated winter harvest of stocked lake trout ranged from 834 fish in 1982 to 2628 fish in both 1983 and 1984. The estimated yield (kg/ha) of stocked fish varied from 0.18 in 1982 to 0.87 in 1986.

ANONYMOUS. Undated$_{g}$. Indian Lake historical events. File data. Ontario Ministry of Natural Resources. Kemptville, Ontario. 1 p.

As a result of the construction of the Rideau canal the water level of Indian Lake was raised by 4 feet. The first records of lake trout stocking was 1925. Plantings have since continued more or less on an annual basis up to and including 1975. Between the mid 1950s to late 1960s there was rapid development of the shoreline. In the late 1960s there was a partial die-off of lake trout due to poor dissolved oxygen levels in the hypolimnion. In 1976 the lake trout management program on Indian Lake was discontinued.

ANONYMOUS. Undated$_{h}$. Redhorse Lake historical events. File data. Ontario Ministry of Natural Resources. Kemptville, Ontario. 7 p.

Prior to 1813 the Marble Rock dam was built causing the water level of the lake to be raised several feet and shallow areas to be flooded. The first record of lake trout being stocked was in 1922. Stocking has continued on a regular (i.e., 6-7,000 yearling lake trout annually) basis since that time. On average, lake trout were stocked at a rate of 8.05 yearlings per surface acre. The contribution of stocked lake trout to the recreational fishery has been monitored through several summer and winter creel surveys. The estimated average return of stocked fish is 20.5%.

ANONYMOUS. Undated$_{i}$. History of fish plantings in the Kawartha lakes. File Report. Ontario Department of Lands and Forests. Lindsay, Ontario.

There are records of seven fish species being planted in the ten Kawartha lakes considered. Only four lakes were involved in plantings of lake trout. Balsam Lake received 20,000 fry in 1924. Clear lake had three plantings - 5,000 fry in 1922; 850 (?) in 1946 and 1,000 fingerlings in 1947. Stoney Lake was stocked in 1922, 1924, 1925 and 1926 with plantings of 5,000, 50,000, 100,000 and 10,000 fry respectively. Sturgeon Lake was stocked with 1,000 (?) in 1922 and 20,000 fry in 1924.

ANONYMOUS. Undated$_j$. Assessment of lake trout stocking in Emsdale Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario.

Lake trout were first introduced to Emsdale Lake in May of 1976. There were 1,500 yearling (16 month old) Lake Manitou strain lake trout stocked at a rate of 24.6 fish ha^{-1}. Fish were marked with right pectoral fin clips. Emsdale Lake was stocked again in 1982 with 2,000 yearling Lake Manitou strain lake trout at a rate of 32.8 fish per hectare. Unfortunately none of these fish were fin clipped.

This project was conducted to determine if the lake trout introduction and stocking of Emsdale lake has produced a fishery. Two 122m multifilament gill nets were set on September 10, 1986 and lifted on September 11, 1986. Only three lake trout (1 fin clipped and two unclipped) were captured. Two of the three fish had freshwater shrimp in their stomachs.

The periodic high fishing pressure, coupled with the fact that the lake has not been stocked since 1982 (4 years ago) may justify the below average gill net catch-per-unit-of-effort. Lake trout stocking of Emsdale lake should continue as it appears to be providing a very successful fishery. In the future, all stocked fish should be fin clipped so that any natural reproduction can be quantified.

ANONYMOUS. 1885. Report of 1884 fish breeding in the Dominion of Canada. Supplement to the Annual Report of the Department of Fisheries, Dominion of Canada. Ottawa, Ontario.

A total of 5,150,000 salmon (lake) trout fry were reared and stocked in 1884. Inland waters of Ontario which were stocked included Muskrat Lake, Stoco Lake, and Lake Simcoe.

ANONYMOUS. 1889$_a$. Report on 1888 fish breeding operations in the Dominion of Canada. Supplement to the Annual Report of the Department of Fisheries, Dominion of Canada. Ottawa, Ontario.

A total of 4,200,000 salmon (lake) trout fry were reared and stocked from the Newcastle hatchery in 1888. Inland lakes which were stocked included Singleton and Charleston lakes in Leeds County, Stoney and Otter lakes in the Peterborough area, Devil's Lake near Irondale, Taylor's Lake near Almonte, Lake Simcoe, and Lake Couchiching.

ANONYMOUS. 1889$_b$. Lake trout for Lake George. Forest and Stream 32(3) : 50-51.

Arrangements have been made for the planting of half a million lake or salmon-trout fry in Lake George during this winter. As the red or square-tailed trout were formerly numerous and of unequalled excellence in the lake and are now practically extinct, there is a splendid opportunity to test whether the lake can be restocked with this finest of all freshwater fish. Their disappearance is attributed to the ravages of pickerel but as this latter fish is much scarcer than formerly, it is believed that red trout can be made plentiful again. It is hoped that those in charge of planting Lake George will make an experiment this winter in that direction.

The lake trout has demonstrated its ability to live and thrive in waters inhabited by pickerel and other members of the pike family. We are not sure, however, that *Esox* is the genus referred to by those who speak of the pickerel in Lake George. We are aware that species of this genus are found in the lake but the pike-perch *Stizostedion* is also called pickerel by many persons and may be the slayer of the red trout. Lake trout will hold their own against all other fishes inhabiting the same waters and the project of planting a half million of the fry in Lake George will probably produce good results. We would like to see, also, a lot of yearlings of the same species used for stocking the lake but not at the same time with the fry.

ANONYMOUS. 1890. Report on 1889 fish breeding operations in the Dominion of Canada. Supplement to the Annual Report of the Department of Fisheries, Dominion of Canada. Ottawa, Ontario.

A total of 2,760,000 salmon (lake) trout fry were reared and stocked in 1889. The fry distributed from this hatchery were liberated in excellent condition, notwithstanding the fact that a large proportion of them were subjected to long journeys. Inland waters of Ontario which were stocked included Charleston Lake in Leeds County; Rousseau Lake, Fairy Lake, Peninsula Lake and Vernon Lake in the Muskoka area; Eagle Lake, Bear Shanty Lake, Wilson's Lake, Nick's Lake and Humphrey's Lake in north Hastings; and Lake Simcoe.

ANONYMOUS. 1892. Report on 1891 fish breeding operations in the Dominion of Canada. Supplement to the Annual Report of the Department of Fisheries, Dominion of Canada. Ottawa, Ontario.

In 1891, a total of 4,750,000 salmon (lake) trout fry were reared at the Newcastle hatchery and 1,380,000 fry were reared at the Ottawa hatchery. Inland waters of Ontario which were stocked included Lake Joseph, Carscallen's Lake near Marmora, Small Lake north of Colborne, Lake Simcoe, and Lake Couchiching.

ANONYMOUS. 1901. Report on 1900 fish breeding operations in the Dominion of Canada. Supplement to the Annual Report of the Department of Fisheries, Dominion of Canada. Ottawa, Ontario.

In 1900, a total of 2,225,000 salmon (lake) trout fry were reared at the Newcastle fish hatchery and 1,860,000 fry were reared at the Ottawa fish hatchery. Inland waters of Ontario which were stocked with these fish included Clayton Lake, Charleston Lake, Sharbot Lake, Eagle Lake, Big Rideau Lake, Christie Lake, Bass lake, Miller's Lake and Wensley (Brule) Lake of eastern Ontario, as well as Lake Simcoe and Lake Couchiching.

ANONYMOUS. 1932. An investigation of the most suitable natural environment for lake trout fingerlings. 25th Annual Report of the Ontario Department of Game and Fisheries, 1931 Session. Paper 9 : 54-56.

ANONYMOUS. 1940. Great Lakes fish planted in South American lake. Progressive Fish Culturist 48 : 36.

In January 1940 several hundred thousand lake trout eggs, furnished by the Bureau of Fisheries hatchery at Cape Vincent, New York, were shipped to Peru. The eggs are destined for the restocking of Lake Titicaca, a 4,500 square mile lake situated at a height of 12,500 feet above sea level. The eggs were shipped via boat and arrived after a trip of fourteen days in length. A trial shipment of lake trout eggs was made last winter but owing to insufficient time for preparation, the outcome was not favourable.

It is expected that they will hatch sometime during March or April and the young fish will subsequently be liberated at various points in Lake Titicaca. The present fish population in the lake is extremely limited and it is hoped that after five or ten years, the time required for the successful outcome of this experiment, the residents of the High Andes will be able to dine on one of the choicest fishery products of the American Great Lakes.

ANONYMOUS. 1951. Need for restocking Lower Rideau Lake. File report, Ontario Department of Lands and Forests. Kemptville, Ontario. 3 p.

It will be necessary to restock Lower Rideau Lake due to the heavy fishing by American and Canadian tourists and cottagers. Lake trout should be stocked heavily. Lake trout fishing has declined greatly according to a great number of residents, fish and game clubs and tourists. There have been several reports made to the writer of careless planting of lake trout. Great numbers of fry were planted in coverless bays – many die and many were attacked by other fish. Planting places for lake trout and whitefish should be west of the Rocky Narrows.

ANONYMOUS. 1952. Algonquin Park creel census and fish plantings, 1951. File Report. Harkness Laboratory of Fisheries Research. Ontario Department of Lands and Forests. Whitney, Ontario.

Plantings of selected lakes with lake trout, speckled trout, and smallmouth black bass were continued in 1951. Five lakes were stocked with a total of 14,000 lake trout fingerlings and yearlings, 11 lakes with 25,000 speckled trout, and one lake with 1,000 bass.

Regular plantings of lake trout have been made in Lake Opeongo since the fall of 1948. Since as high as 85-90% of all trout caught in Lake Opeongo are examined by the census takers and the planted trout are marked it is hoped some indication of the success of the plantings may be obtained in this lake. The effects of the first plantings may be seen in the fishery next year.

ANONYMOUS. 1953. Plantings of game fish in 1953. File Report. Harkness Laboratory of Fisheries Research. Ontario Department of Lands and Forests. Whitney, Ontario.

The following lake trout plantings were made in 1953: Brewer Lake (2,500 fingerlings), Kearney Lake (2,500 fingerlings), Swan Lake (600 fingerlings), Sylvia Lake (1,900 fingerlings), Raven Lake (2,500 fingerlings), Rock Lake (3,000 fingerlings), Cache Lake (3,000 fingerlings), Source Lake (3,000 fingerlings), Sawyer Lake (1,000 fingerlings) and Sunday Lake (2,000 fingerlings). This is in line with the policy since 1947 of planting heavily fished lakes along the highway in alternate years with lake trout. Because of the shortage of census staff it has been impossible to maintain an adequate census on these lakes and the success of these plantings is not known.

In Lake Opeongo, the fish have been clipped so that some indication of the success of the plantings may be learned. Only six clipped fish were returned in 1953 which suggests a low survival of the early plantings. It is planned to hold the 1953 Opeongo plantings of lake trout in a small bay before release to give the fish a better chance of survival.

ANONYMOUS. 1959. Lake trout plantings being tested. *In* A Guide to Angling in Algonquin Provincial Park. Department of Lands and Forests. Whitney, Ontario.

About the same time creel census returns indicated that lake trout angling had deteriorated in those heavily fished lakes accessible by road, restocking was undertaken. Since 1947, Smoke, Burnt Island, Source, Cache, Two Rivers, Rock and Whitefish lakes have been planted every other year with 2-4,000 fingerling lake trout. Many summer residents in the Algonquin Park express surprise when learning this but most of the plantings take place in late October. At this time the trout are larger and the lake waters are uniformly cold. Both of these conditions encourage better survival of the trout.

Lake Opeongo, the most heavily fished lake, receives the most generous plantings. From 10,000 to 44,000 fingerling and yearling lake trout have been planted there every other year since 1948. A large proportion of these fish have been marked. Up to 1958, less than 25 of these hatchery fish have been caught in Lake Opeongo.

ANONYMOUS. 1962. Michigan: Lake trout planted in six lakes. Commercial Fisheries Review 24(12) : 46.

Michigan's late fall trout planting program called for some 32,500 lake trout to be released for restocking six lakes in the northern peninsula, announced the Michigan Department of Conservation on November 1, 1962. A total of 5,000 lake trout were released in Big Glen Lake, Leelanau County, during the latter part of October. Other lakes scheduled for lake trout restocking early in November were: Higgins Lake, Roscommon County, 10,000 fish; Elk and Torch lakes, Antrim County, 5,000 each; Walloon Lake, Emmett County, 5,000; Lake Avalon, Montmorency County, 2,500. The plantings were made at dusk when seagulls have less chance of preying on the fish before they take to deep water. Releases consisted of 2-year-old lake trout measuring 7 inches and longer. About 5,000 lake trout were planted in Crystal Lake, Benzie County, in the spring of 1962, as part of Michigan's Department of Conservation 1962 lake trout planting program.

ANONYMOUS. 1964. Michigan: Lake trout stocking program continued in fall 1963. Commercial Fisheries Review 26(1) : 20-21.

Plantings of about 300,000 lake trout were made in 15 northern Michigan lakes by the Michigan Department of Conservation in the fall of 1963. The plantings, made up of about 260,000 fingerlings and 40,000 keeper-sized fish, were carried out as part of a continuous program to maintain lake trout numbers in inland waters where there is virtually no natural reproduction by these fish. The releases of fingerlings totaled 100,000 in Lake Michigamme; 10,000 in Little Oxbow Lake; 50,000 each in Golden and Smokey lakes; and 50,000 in Walloon Lake. Plantings of legal-sized lake trout included 5,000 in Glen Lake; 1,245 in Grand Sable Lake; 100 and 1,000 in Tilden and Squaw lakes; 2,500 in Lake Bellaire; 3,000 each in Chicagon and Golden lakes; 10,000 and 5,000 in Elk and Torch lakes; and 9,300 in Higgins Lake. Another 55,775 legal and sub-legal lake trout were released in the spring of 1963 in Crystal Lake, Walloon Lake, Golden and Chicagon lakes, Tilden and Squaw lakes, and Lake Avalon.

ANONYMOUS. 1965$_a$. Fish plantings. p. 84-85. *In* A History of the Sault Ste. Marie District. District History Series No. 20. Ontario Department of Lands and Forests. Toronto, Ontario.

The fish planting program has witnessed considerable revisions since the pre-amalgamation days (Department of Game and Fisheries and Department of Lands and Forests). It was the practice in this district to plant, on application from the public, tens of thousands of walleye, black bass, brook trout, lake trout and rainbow trout annually. In 1947, some 95,500 lake trout fingerlings were stocked; in 1962 40,000 yearlings were stocked; and in 1965 100,000 lake trout yearlings were stocked in the Sault Ste. Marie district. In 1957, the method of planting fish was completely revised. In an effort to more effectively and efficiently plant fish, it was decided to use aircraft for transportation to lakes and also as a means of planting.

ANONYMOUS. 1965$_b$. Fish culture. p. 108-113. *In* A History of the Lindsay Forest District. District History Series No. 18. Ontario Department of Lands and Forests. Toronto, Ontario.

In 1875, the collection at Samuel Wilmot's Newcastle hatchery consisted of one million salmon eggs, 300,000 salmon trout (lake trout) eggs and 200,000 whitefish eggs. Salmon trout were planted in a number of lakes "back of Peterborough and under the auspices of the Fish and Game Society of that neighbourhood." In 1880 lake trout fry were planted in several Lindsay district lakes including Crow Bay (100,000 fry), Stoney and Otter lakes (200,000 fry) and Devil's Lake near Irondale (50,000 fry).

In 1895, there is first mention of Brady Lake near Minden receiving a plant of lake trout. Four Mile Lake was stocked with 25,000 lake trout in 1904 and several lakes in the Haliburton and Wilberforce areas also received lake trout.

By the turn of the century, the importance of the Newcastle hatchery was on the wane. In the period 1905-1907, production had dwindled to about 1.5 million lake trout fry annually. Fish were still raised at Newcastle until 1912 or 1913 until there were no more reports of activity.

ANONYMOUS. 1970. Algonquin Park: Annual project report of the research branch of the Department of Lands and Forests. Maple, Ontario.

An analysis of the Lake Opeongo lake trout fishery had indicated that exploitation can limit spawning escapement and recruitment to the fishery, a planting program was carried out on the lake from 1948 to 1964 to supplement the native stock. Approximately 158,000 yearlings and 51,000 fingerlings were planted in the lake during this period. Marking of the yearling stock and an active creel census program have permitted an evaluation of this management practice. Stock has been obtained from a variety of sources including Great Slave Lake, Lake Superior, Lake Manitou, Lake Simcoe and Algonquin Park lakes. Various planting techniques including planting site, depth and time of year of planting, the use of acclimation or holding areas, air and hand drops, and various other methods have been employed but returns to the fishery have been negligible (less than 0.01%).

Restocking experience in Algonquin Park and in other areas has suggested that source of stock, particularly water quality (hard vs. soft), may be a factor in survival. Stock for plantings in 1961, 1963 and 1964 of about 119,000 marked yearlings and 7,000 fingerlings was derived from hard and soft water lakes (Lake Simcoe, Lake Opeongo, and Lake Lavieille respectively) and half of each lot was raised in a hard and soft water hatchery. The returns to date of these plantings are summarized. Total returns from all sources have been low at 0.04%. Because of the limited recaptures of hatchery fish any further interpretation of the data is unwarranted at this point. As was pointed out in the 1968 annual report there has been a high regeneration of the clipped fins and it is possible some hatchery fish may have escaped detection. However, as 5 of the 12 lots planted in 1963 and 1964 have an adipose clip (which does not regenerate), and as few of these clips are turning up, it appears that the large numbers of small fish evident in recent years are native rather than planted trout.

As accumulating evidence indicates larger stocked trout may have a higher survival rate, future plantings of lake trout in Lake Opeongo will be of 2-year old stock. In 1970 eggs were collected from Lake Opeongo (soft water) and the Fish and Wildlife Branch provided eggs from Lake Simcoe (hard water). Half of each lot is presently being raised in a soft water and hard water hatchery (Pembroke and Wiarton, respectively). A total of 10,000 lake trout (2,500 from each lot) will be planted in Lake Opeongo in 1973 as two-year olds.

It is hoped a potentially higher survival rate in these fish will shed more light on the significance of stock source on survival and with the use of larger fish there should be less fin regeneration.

ANONYMOUS. 1971. Relationship of strain and size at planting to the relative survival of lake trout. Project No. F-22-R-12. New York State Department of Environmental Conservation. Albany, New York.

Six northeastern New York Lakes were sampled to evaluate growth and survival of two strains and three age groups of planted lake trout. The lakes were Third Lake, Fourth Lake, Millsite Lake, Hoel Pond, Polliwog Pond and Eighth Lake.

We recorded 244 lake trout from these lakes during 1970. Gill nets captured 219 lake trout and anglers provided returns for 25 additional fish. One-hundred and seventeen (53.4%) of the lake trout caught in gill nets had been planted during this study. Accumulative captures during the years of 1965-1970 consist of 301 Upper Saranac Lake strain and 20 Seneca Lake strain lake trout. Greater survival of the Upper Saranac Lake strain is highly significant for combined findings from eight lakes. A ninth lake failed to support plantings of either strain.

Accumulative returns from fall fingerling, spring yearling and fall yearling plantings total 25, 175 and 121 fish, respectively. Findings during 1970 disclosed that differential survival between spring and fall yearling lake trout plantings may not be as pronounced as was indicated by previously collected data. Survival of fall fingerling plantings continued to be poor. Growth data for Upper Saranac Lake strain fingerlings and yearlings is presented and discussed.

It is recommended that sampling be continued in four study lakes. Recommendations are made concerning the use of Upper Saranac Lake strain lake trout for maintenance stockings.

ANONYMOUS. 1972. Relationship of strain and size at planting to the relative survival of lake trout. Project No. F-22-R-13. New York State Department of Environmental Conservation. Albany, New York.

Five northeastern New York lakes were sampled during 1971 to evaluate growth and survival of two strains and three age groups of planted lake trout. The lakes were Third lake, Fourth Lake, Eighth Lake, Millsite Lake and Hoel Pond.

We recorded 225 lake trout from study lakes during 1971. Gill nets captured 102 lake trout and anglers provided for 23 additional fish. One-hundred and nineteen (58.9%) of the lake trout caught in gill nets had been planted during this study. Accumulative captures during the years of 1965-1971 consist of 415 Upper Saranac Lake strain and 24 Seneca Lake strain lake trout (different individuals). Greater survival of the Upper Saranac strain is highly significant for combined findings from all nine study lakes.

Survival of fall fingerling plantings has been poorest and combined returns from all lakes was greatest for the spring yearling followed by the fall yearling lake trout. However, this trend was not consistent for individual lakes. Accumulative growth data for Upper Saranac Lake strain fingerling and yearling plantings is presented.

It is recommended that sampling be discontinued under this study. Final analysis of data be completed and a publication be prepared during the next segment.

ANONYMOUS. 1976. Winter creel surveys for Charleston Lake. Unpublished data. Ontario Ministry of Natural Resources. Brockville, Ontario.

Charleston Lake is a 6,220 acre lake located in Leeds County of southeastern Ontario. The lake has been stocked at a mean annual rate of 12,683 lake trout annually (2.04 fish acre^{-1}) over the past fifteen year period.

Creel census data for the 1969-70 to 1974-75 winter fisheries and five open water fisheries (1960, 1966, 1967, 1970 and 1975) are summarized. Estimated fishing pressure averaged 12,526.7 (2.01 rod hrs ha^{-1}) and 48981.0 rod hours (7.87 rod hrs ha^{-1}) for the winter and summer fisheries, respectively. This amounts to 61,507.7 rod hours of effort (9.87 rod hrs ha^{-1}) annually.

During that period an average of 15,808 pounds (2.54 lbs acre^{-1}) of lake trout were harvested annually. Stocked lake trout contributed an average of 18.2% to the lake trout catch.

ANONYMOUS. 1983. The 1983 winter lake trout fisheries of Dickey, Thanet and Wollaston lakes, Hastings County. File Report, Haliburton-Hastings Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Bancroft, Ontario. 19 p.

Creel census was conducted on three lake trout fisheries during the winter (January 17- late March) of 1983. The winter of 1983 was unusually mild with little snow. Safe ice was not present until mid January.

On Dickey Lake stocked fish comprised 25% of the total catch (137 trout examined). Stomach contents consisted mainly of amphipods (54%), fish (25%) and insects (20%) including caddisflies and mayflies.

Stocked fish comprised 13% of the total catch on Wollaston Lake. Of the 180 lake trout specimens examined during the course of the study, 23 had been fin clipped. Stomach contents consisted mainly of amphipods (56%), fish (32%) and insects (12%) including mayflies and stoneflies.

The Thanet Lake lake trout fishery was supported almost entirely by native lake trout. Only 1 of 13 fish examined was a stocked fish.

ANONYMOUS. 1986. 1986 creel survey on L'Amable Lake. File Report. Ontario Ministry of Natural Resources. Bancroft, Ontario.

The 1986 creel survey operated from June 29 to September 9 on L'Amable Lake. An estimated 1,796 angler hours or 10.07 hours ha^{-1} were exerted on the L'Amable Lake fishery during the survey period. Seventeen lake trout were sampled during the summer survey. Stocked lake trout represented 50% of the sample and were from the 3 and 5 year age group.

ANONYMOUS. 1987_a. 1986 and 1987 summer creel census on Bay Lake. File Report. Ontario Ministry of Natural Resources. Bancroft, Ontario.

A summer creel census was conducted on Bay Lake during 1986 and 1987. The total estimated effort spent during the spring and summer of 1987 was 1,546 hours of 18.21 hours ha^{-1}. Thirteen lake trout were sampled in 1986 and 10 were sampled in 1987. Hatchery fish represented 46% and 60% of the 1986 and 1987 samples respectively. All of the hatchery fish caught in 1987 and 67% of those caught in 1986 represented fish stocked in 1984.

ANONYMOUS. 1987_b. Creel surveys, 1983-1984. File Report, Algonquin Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Whitney, Ontario. 68 p.

Bark Lake has been stocked regularly since 1966 to compensate for loss of natural reproduction from an annual drawdown of 10 m by Ontario Hydro. Marked lake trout represented 69% of the catch during 1983. In the past, the percentage of marked fish in the creel has ranged from 26.7% to 64.8%. Several plantings in recent years were unmarked which serves to mask the impact of lake trout stocking on the angler harvest as well as the possible presence of naturally reproducing lake trout.

ANONYMOUS. 1990. Evaluation of the status of lake trout in Baptiste Lake. File Report. Ontario Ministry of Natural Resources. Bancroft, Ontario.

Although the original sport fish community of Baptiste Lake probably consisted of lake trout, brook trout, burbot and lake whitefish, there have been considerable changes in the lake and fish community through stocking. Lake trout stocking commenced in 1923. In 1952 stocking of lake trout was discontinued. The reason for the decision is not clear. Perhaps it was related to the fact that following construction of the dam, large portions of the lake provided suitable habitat for warmwater species and the lake was no longer viewed as a lake trout lake. Shoreline development was also considered a primary cause of habitat loss. Based on spawning studies it is apparent that lake trout occur in Baptiste Lake and that these lake trout are reproducing naturally.

ARMSTRONG, G. S. 1947. Mortality, rate of growth and fin regeneration of marked and unmarked lake trout fingerlings at the provincial fish hatchery, Port Arthur, Ontario. Transactions of the American Fisheries Society 77 : 129-131.

The experiment was initiated in an attempt to determine the effect resulting from the excision of the adipose fin of lake trout (*Cristivomer namaycush*). The experimental fish (500 marked and 500 unmarked) taken at random from fish handled during the daily clipping operation were weighed and measured and placed in two troughs allocated for the experiment.

In June 1948 after a lapse of 10 months the fish were counted and examined. The aggregate loss was 13 or 2.6% of the marked fish and 20 or 4.0% of the unmarked fish. Measurements indicated no appreciable difference in the length and weight. The growth increments were 4.59 cm and 6.79 g in marked fish and 4.56 cm and 6.77 g in the unmarked fish. A total of 24 or 4.9% of the marked fish exhibited varying degrees of regeneration. Of this total, 17 fish or 3.47% could be identified as marked fish.

ARMSTRONG, G. C. 1949. Progress report on the lake trout studies conducted in the Port Arthur district, 1949. File Report. Ontario Department of Lands and Forests. Port Arthur, Ontario. 10 p.

For the past three years lake trout studies involving the marking, planting and return of hatchery-reared fish have been conducted in the Port Arthur District. The experiment was initiated with the view to determining the value of our hatchery plantings; the more preferable age at which to release hatchery-reared lake trout; and, finally, to learn something more on the habits and habitat of the species.

During the period of 1946 and 1947, a total of 20,135 lake trout yearlings were marked by the removal of the adipose (1946) and the adipose and left pectoral (1947) fins and planted in three lakes; namely Trout Lake, Cliff Lake and Lake Superior (Rossport). In 1947 and 1948, another 90,507 lake trout fingerlings were marked by a similar fin pattern and released in Arrow Lake, Oliver Lake and Lake Superior.

The final or creel census phase of the experiment was commenced on each experimental water immediately following the release of hatchery marked fish. Although few returns, if any, were anticipated the first year or the second or third year in the case of fingerling marked trout, it was nevertheless imperative that a census procedure be established as soon as possible in order that a complete return might be expected.

ARMSTRONG, G. C. 1950. Progress report on the lake trout studies conducted in the Port Arthur district, 1950. File Report. Ontario Department of Lands and Forests. Port Arthur, Ontario. 7 p.

This report will discuss the studies conducted in 1950 up to September 20. This year an additional 49,888 lake trout fingerlings were marked and released in Lake Superior. In Lake Superior, the return of lake trout marked as yearlings compares favourably with that of the past two years. A total of 19 specimens have been retrieved and confirmed as hatchery marked fish as well as an additional four fish which could be classed as probables. Present records indicate that 50 fish or 1.11% of the 1945 year class have been captured in contrast to 16 or 0.16% of the 1946 year class.

No marked lake trout were reported from Trout Lake in 1950. Sport fishing continued to increase on Cliff Lake. During the summer a total of 36 specimens were reported. Of this total, 24 fish were described as adipose marked trout, 4 as adipose and left pectoral marked trout and 8 as marked fish but not identified as to the year class. This collection brings the aggregate return to 44 fish or 2.68% of the planting. Creel census data collected on Arrow Lake in 1950 was limited. No records of marked fish were received during a rather intensive creel study on Oliver Lake in 1950.

ARMSTRONG, G. C. 1951. Progress report on the lake trout studies conducted in the Port Arthur district, 1951. File Report. Ontario Department of Lands and Forest. Port Arthur, Ontario. 5 p.

In 1951, the censusing program, as in the past, was largely dependent on the angler's cooperation. At least one visit was made to each of the waters concerned except for Cliff Lake where a bridge washout isolated the lake from road travel.

Overall, the returns were fewer than in 1950. In Lake Superior, fourteen marked hatchery fish were retrieved. Of this total, 11 were identified as the 1945 year class; three as 1946 year class and one as the 1947 year class.

No angling returns were received from Trout Lake. Cliff Lake was not fished to any degree in 1951 due to the access restrictions (bridge washout). The first and only return of a hatchery marked fish was taken from Arrow Lake this year. Two hatchery marked lake trout from the 1947 year class were retrieved from Oliver Lake.

Since general interest and cooperation, on the part of anglers, appears to be waning it is recommended that provision be made for personnel to assist in the censusing of returns and the publicizing of the experiment.

ARMSTRONG, G. C. 1952. A summary of the hatchery marked lake trout returns for the Thunder Bay district. File Report. Ontario Department of Lands and Forests. Thunder Bay, Ontario. 4 p.

The lake trout studies considered during the current year were concentrated on the collection of a complete and detailed record of all hatchery marked lake trout retrieved from Lake Superior. This year marked the largest reported return of hatchery marked fish since the experiment was initiated in 1945. A total of 45 records were received on marked fish retrieved by commercial fishermen. Of this total, 19 fish were classified as authentic returns and the remaining 26 are considered as doubtful. Based on acceptable, authenticated returns this amounts to nine from the 1945 year class; three for the 1946 year class; six for the 1947 year class; and one for the 1948 year class. These figures, when included with the previous returns make an aggregate of 70 fish or 1.56% return for the first planting; 22 or 0.22% for the second; nine or 0.03% return from the third; and one or less than one-thousandth percent for the fourth. The fifth year class, planted as fingerlings in 1950, has not been reported in the fishery.

ARNDT, S. K. 1989. Creel survey of the 1988 Lake Simcoe summer fishery. Report 1989-2, Lake Simcoe Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Sutton, Ontario.

A stratified roving creel survey was conducted on Lake Simcoe from May 14 to September 5, 1988. Total estimated angling effort was 191,292 rod hours. The total estimated harvest was 87,645 fish of which 7,073 were lake trout.

Ninety-six percent of the lake trout caught were clipped and therefore of hatchery origin. The unclipped fish ranged in size from 0.7 kg to 5 kg and may have been from natural reproduction, observation error or clipping error. This indicates that the fishery is completely dependent on the stocking program. This was considered to be the situation in the summer of 1983 as well when 86% of the charter boat catch was fin clipped. Percentages of clipped fish from 1977 to 1979 were from 68-69% and most unclipped fish were older. A trend of decreasing numbers of unclipped fish with increasing harvest corresponding to increased stocking has been evident in the winter fishery as well. Up to this point there is no indication that the lake trout stocking program on Lake Simcoe has contributed to the rehabilitation of a self-sustaining population. With the failure of natural reproduction, year class strength in the future will continue to be determined by the success of the stocking program in a given year.

AUCLAIR, R. P. 1976. Moosehead update. Maine Fish and Wildlife 18(1) : 4-7.

The Moosehead Lake study is winding down after its 9th year. The togue (lake trout) situation in Moosehead Lake is still changing, we hope for the better. We believe the initial decrease in the lake trout population was caused by more frequent drawdowns of the lake water level in late fall and winter. To remedy this situation we entered into a water control agreement with the Kennebec Power Company. Another measure we took was to stock hatchery lake trout. We planted 50,000 yearlings in 1968, 30,000 in 1970, and 50,000 each year beginning in 1972. All stocked trout were marked by removing one or two fins.

BALDWIN, N. S. 1950. The Algonquin Park creek census, 1950. File Report. Ontario Department of Lands and Forests. Whitney, Ontario. 11 p.

For fifteen years the creel census has been following trends in the fishing quality of southern Algonquin Park lakes. As in past years, one census man was stationed at Lake Opeongo and one man was stationed at Cache Lake.

The total reported lake trout catch in Opeongo this year was the highest since 1949. This large catch was due primarily to a substantial increase in fishing effort and an increase in the abundance of young trout entering the fishery. Generally, there was a decline in angling quality immediately prior to the war followed by an increase in quality during the war. The fact that increase angling pressure in the years following 1945 was seriously limiting natural reproduction was realized and steps were taken to supplement natural reproduction with hatchery plantings. A schedule of planting in alternate years was established and the first shipment of hatchery stock was introduced into Opeongo in the fall of 1948. The success of this measure will not be apparent, however, for several years.

BANDOW, F. 1987. Fluorescent pigment marking of seven Minnesota fish species. Fisheries Investigational Report No. 393. Minnesota Department of Natural Resources. St. Paul, Minnesota. 38 p.

The use of sprayed fluorescent pigment for marking small fish was tested on a number of fish species including lake trout (*Salvelinus namaycush*). Some of the hatchery-raised lake trout for the 1984 Lake Superior stocking were marked as fingerlings in fall with red pigment and the remainder were marked as yearlings in spring with yellow pigment. Lake trout mortality attributable to pigment marking was low. Through the first 13 days after fingerling marking, 21 mortalities occurred among the estimated 22,900 marked fish. Pigment marked lake trout yearlings held in raceways for 95 days grew slightly less than unmarked controls.

BARNES, L. E. 1982. Lake Manitou summer creel census 1982. File Report. Ontario Ministry of Natural Resources. Espanola, Ontario. 16 p.

During the period of May 21, 1982 to September 27, 1982, a roving creel census was conducted on the eastern basin of Lake Manitou. A total of 960 angling parties were contacted during the 75 sampling days. The estimated total fishing pressure for the season was 43,806 man-hours. The average angling success during the study was 0.1219 lake trout per rod-hour, which compares very favorably with other highly productive lake trout lakes. The estimated harvest of 0.89 kg/ha is also relatively high although it has dropped since 1979. As with recent studies on the lake, the catch consisted of about 6% native lake trout and 94% fish of hatchery origin.

BARNES, L. E., R. R. CLAYTOR and N. G. MacLEAN. 1984. The sport fisheries of Big Clear, Big Rideau, Big Salmon, Charleston and Devil lakes, 1983. Report No. 8, Rideau Lakes Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Sharbot Lake, Ontario. 124 p.

In 1983, the Rideau Lakes Fisheries Assessment Unit conducted both a winter and summer creel census on Big Clear, Big Rideau, Big Salmon, Charleston and Devil lakes.

On Big Clear Lake the observed winter catch-per-unit-of-effort (CUE) was 0.084 and the observed harvest-per-unit-of-effort (HUE) was 0.070. Overall, an estimated 442 lake trout were caught, of which 354 were harvested. The lake trout harvest consisted largely of age IV and V fish. Fifty-five percent of all sampled fish were of hatchery origin. During the open water fishery, the observed CUE and HUE was 0.104 and 0.079, respectively. An estimated 12 lake trout were caught and all were native fish. Both hatchery and native fish recruited to the fishery at age 3.

An estimated 22,123 and 77,706 rod hours of angling effort were expended on Big Rideau Lake during the winter and open water fisheries. In the winter fishery an estimated 2,343 lake trout were caught of which 1,896 were harvested. In the open water fishery an estimated 9,717 fish were caught and 7,269 were kept. In total, over 62% of the lake trout harvested in 1983 were of hatchery origin. Of these fish the 1978-79 year classes contributed most noticeably to the harvest. The percent return of stocked fish for the range of year classes represented in the 1983 sport fishery was 3.3%.

On Big Salmon Lake anglers fished an estimated 5,982 rod hours to catch 349 fish in the winter fishery. In the open water fishery, anglers exerted 1,516 rod hours to catch 84 lake trout. Overall, hatchery-origin lake trout made up 68% of the harvest. The highest returns of hatchery-origin lake trout were from the older year classes (1975, 1976) which also had the greatest stocking rates (approximately 14 fish ha^{-1}).

An estimated 22,856 lake trout were caught from Charleston Lake in 1983 (winter and summer combined). Fifty-three percent of the catch were fish of hatchery origin. Hatchery fish made up a particularly large proportion of the younger (e.g., ≤ 5 years of age) age groups. The percent return of stocked lake trout for the range of year classes represented was 6.29%.

On Devil Lake it was estimated that 1,557 lake trout were harvested in the winter and 2,631 fish were caught in the summer. Only 10.2% of the lake trout sampled were of hatchery origin. The percent return for the range of year classes represented was 1.35%.

When 1983 information for all lakes is examined, the annual percentage return of hatchery-origin lake trout for all year classes represented in the harvest ranged from 1.35-6.29%. Stocking success over the last three years was quite variable between lakes, years and seasons. In general, no relationship between stocking rate and year class strength is evident. The potential return from a stocking program appears to be, in part, dependent on the health of the native lake trout fishery.

BEAN, T. H. 1916. Fish planting in public waters: A guide for stocking the inland waters of New York State with food and game fish. Division of Fish and Game. New York State Conservation Commission. Albany, New York.

Methods for planting various species of fish such as the brook trout, rainbow trout, brown trout, lake trout and land-locked salmon are discussed. It is suggested for lake trout (*Cristivomer namaycush*) that fry be stocked in March or April and fingerlings anytime from May to July. They should be planted on rocky shoals or reefs that are in close proximity to deep water.

BEANGE, S. W. 1974. Lake Manitou winter creel census, 1974. File Report. Ontario Ministry of Natural Resources. Espanola, Ontario.

During the winter of 1974, 1,331 anglers were checked on Lake Manitou with 334 lake trout for a success of 0.07 trout per hour. A total of 40 days were spent checking fishermen.

Recommendations given in the paper include:

- Litter bags be passed out to the fishermen by the Ministry of Natural Resources.
- A control be set on the quantity of fish a person can possess, to possible aid the lake trout populations. Hatchery-raised fish accounted for a large (80%) proportion of the total catch this past winter and for several previous years.
- It is recommended that at least 80,000 yearling or older lake trout be stocked in Lake Manitou each year. There has been a lot of discussion regarding summer fishing and netting during spawning time on Lake Manitou but little information is available regarding the actual quantities removed.
- It is recommended that a summer creel census be carried out as well as a program to try to determine what quantity of lake trout is removed by other means.
- It is recommended that the identification of hut owners be visible outside their huts in order to deter fishermen from littering and to be able to lay littering charges if needed.

BEANGE, S. W. 1976$_a$. Lake Manitou winter creel census 1975. File Report. Ontario Ministry of Natural Resources. Espanola, Ontario. 17 p. + appendices.

During the Lake Manitou winter creel census 1975, 1,266 anglers were checked. They had fished for 3,820 hours and caught 424 lake trout for a catch rate of 0.110 trout per rod-hour.

When calculating total pressure and harvest, it is estimated that 2,216 anglers spent 12,099 hours to catch 1,353 lake trout during the 63 days covered by the survey.

Conclusions and recommendations may be summarized as follows:

- Lake Manitou appears to be a lake providing considerable fishing recreation during the winter months for lake trout as well as perch and whitefish.
- A large percentage (64.7) of lake trout caught were of the three and four year old age class and averaged 0.26 and 0.51 kg, respectively.
- A high percentage (81.6) of stocked fish were caught. This percentage has been on a steady increase since 1970. During 1975 the percentage of planted fish decreased as the age of the fish increased.
- It generally seems that younger (3 and 4-year-olds) and therefore smaller fish are caught in deeper water (over 80 feet) while older and larger fish are caught in shallower water (under 80 feet, usually 40 to 60). Of the proportion of Lake Manitou surveyed, quadrants one and four contained the areas of deep water and produced most of the smaller fish.
- The author suggests that, after one more year of conducting a similar census, the census be dropped for a year or two or else carried out in a much more simplified manner. An intensive survey every second or third year could yield sufficient information to reliably estimate the missed years.
- Whether or not it is done each year the census must be done properly, both from a statistical as well as a practical viewpoint. A positive objective must be set out; a method designed to obtain this objective and men and proper equipment provided to carry out the program. The people doing the actual field work will have a great influence on the reliability of information gathered and therefore must be thoroughly familiar with the entire project.
- In light of problems encountered with entry of information from the creel census interview card, it is suggested that some different method be used. As suggested earlier, a modified form containing only information required for analysis at the district level might prove to be more successful.

BEANGE, S. W. 1976$_b$. Lake Manitou winter creel census 1976. File Report. Ontario Ministry of Natural Resources. Espanola, Ontario. 13 p. + appendices.

During the winter of 1976 an intensive creel census was conducted on the eastern half of Lake Manitou located on the Manitou Island within the Espanola District. During these twenty survey days, 820 anglers were interviewed. These anglers spent 2,287 hours fishing and caught 308 lake trout for a catch rate of 0.134 trout per rod-hour.

A low survey percentage caused by poor travel conditions during the first part of the survey made estimates of total pressure and harvest difficult. A modified survey eliminating the first 26 days, during which most travel difficulties arose, yielded a higher survey percentage.

One point which was very evident throughout the survey was the high percentage of stocked fish. This percentage has steadily increased from a low of 24.8 in 1970 to a high of 90.9 in 1976.

BEANGE, S. W. 1978. Lake Manitou winter creel census report, 1978. File Report. Ontario Ministry of Natural Resources. Espanola, Ontario. 7 p. + appendices.

During the Lake Manitou 1978 winter creel census a total of 743 anglers were observed. They had fished 1,762.3 hours and caught 210 lake trout for an overall catch rate of 0.119 trout per angler hour. Of the 216 trout sampled, the total number of stocked fish was 192 (88.8%). In a comparative study of fish stocked through the ice and those stocked in the spring (open water), there were no differences in returns to the fishery. For unknown reasons, hatchery-reared trout consistently represent approximately 90% of the lake trout sampled from the winter fishery. In light of this high return, it is recommended that stocking efforts be maintained at their present rate.

BELFRY, S. 1997. Talon Lake 1997 spring littoral index netting (SLIN) analysis and summary of results. File Report. Ontario Ministry of Natural Resources. North Bay, Ontario.

Twelve lake trout were caught in 30 sets, providing a catch-per-unit-of-effort (CUE) of 0.4 trout per set. In addition to the 12 trout that were brought into the boat, 2 other lake trout fell out of the net close to the boat. If these two fish are included in the catch then the CUE was 0.47 trout per set.

The 12 lake trout measured had a mean fork length of 46.2 cm. If the mean fork length of the catch is expressed in mean fork length of lake trout per set (to take into account both the number of trout caught and their average size), including the 2 escaped trout and assuming they were of average size, then the mean fork length of lake trout per set was 21.6 cm (46.2 mean fork length; 14 trout captured/30 sets). Perhaps this figure can be used as an index when making comparisons from year to year or lake to lake which recognizes both the number of fish and the size of the fish caught.

The 12 lake trout that were measured had a mean weight of 1,414 grams. If the CUE is expressed in grams of lake trout per set, including only the 12 trout that were weighed, the results would be 567 grams per set. If the two lake trout that escaped are included in the catch, and it is assumed they were of average weight, then the CUE = 661 grams per set.

Of the 12 trout closely observed, 50% were fin clipped.

BELFRY, S. 1998$_a$. Memesagamesing Lake 1997 spring littoral index netting survey, 1997 lake trout spawning survey and lake trout review. File Report. Ontario Ministry of Natural Resources. North Bay, Ontario. 6 p. + appendices

Stocking records indicate that Memesagamesing (Sag) Lake was first stocked with lake trout in 1938. It has been stocked with trout roughly every year or two since that time and nine out of the past 10 years. In the last 10 years, it has been stocked with a total of 39,100 yearlings and 240,000 eyed eggs. Any trout resulting from the stocking of eyed eggs would not be marked (hatch years 1994, 1995 and 1996).

In the spring of 1997, Sag Lake was netted, using the spring littoral index netting (SLIN) protocol, to obtain a measure of the relative abundance and structure of the lake trout population. Twenty-nine lake trout were captured in thirty net sets resulting in a catch-per-effort (CUE) of 0.97 trout per set. The mean fork length of captured lake trout was 37.0 cm and the weight weight was 807 grams. Of the twenty-eight lake trout which were examined, 75% were fin clipped. In the north basin, 45% were clipped while in the south basin 94% were clipped. None of the captured lake trout were small enough to have been from the recent eyed eggs plants. Two of the largest trout may have been stocked unclipped so between 18-25% of the trout captured were likely native. In the south basin of the lake, only 1 of the 17 trout capture was unclipped suggesting that 6% of the trout were native. In the north basin, 6 of the 11 trout capture were unclipped Since two of the large trout may have been stocked unclipped, the native trout comprised between 35-55% of the catch.

The native population appears to be so poor in the south basin that without stocking there would be very few lake trout at all. Stocked fish may encourage the development of a native population by reducing the herring numbers thereby reducing competition for food between small trout and herring, leading to increased survival of small trout. Further, the stocked fish may be the only real spawning stock available in the south basin at this time. Stocking should be maintained. Trout which were to be stocked in the north basin could be diverted to the south basin.

Anglers, if they are going to keep trout for the table, should be encouraged to keep stocked fish before native fish. The native fish are more likely to contribute to the spawning stock than the stocked fish and to produce offspring which are better adapted to the lake than the stocked fish.

BELFRY, S. 1998$_b$. Lake Memesagamesing volunteer creel record winter 1998. File Report. Ontario Ministry of Natural Resources. North Bay, Ontario.

Lake trout information derived from this study is summarized. A total of 57 lake trout were caught during 151.5 angler hours of fishing effort. This produces a catch-per-unit-of-effort of 0.38 trout per angler hour. The mean length of the lake trout catch was 33.5 cm. Fifty-six percent of the lake trout were fin clipped indicating their hatchery origin. Most lake trout (40 fish) were angled from the north basin of the lake.

BENTLEY, W. G. 1950. Initial study on the recovery and relative survival of fingerling and yearling lake trout stocked in Cayuga Lake. M. Sc. Thesis, Cornell University. Ithaca, New York. 62 p.

Two conclusions can be drawn from the data presented in this thesis: (1) several times better survival of yearlings compared to fingerlings is indicated; and (2) natural reproduction has contributed little to the 1946 and 1947 year classes.

BERKA, R. 1986. The transport of live fish: A review. Technical Paper 48. European Inland Fisheries Advisories Commission, Food and Agriculture Organization of the United Nations. Rome, Italy.

The basic principles of fish transport and the main factors affecting it (fish species, fish developmental stages and quality, transport time, temperature, oxygen content, fish metabolism products, etc.) are evaluated on the basis of an analysis of the pertinent literature. For the two basic fish transport systems, the closed and the open, the transport units are described and the densities of transported fish per unit volume under actual conditions are tabulated for guidance. The survey is complemented by the description of the existing methods for the chemical treatment of the environment inside the transport systems and for the treatment of the fish transported, such as fish anaesthetics, chemical water conditioning and antibacterial treatment.

BISHOP, D. L. 1992. Interaction between adult lake trout abundance and recruitment of stocked salmonines in Cayuga and Seneca lakes. M. Sc. Thesis, College of Environmental Science and Forestry, State University of New York. Syracuse, New York. 65 p.

BLACK, E. C. 1955. Appearance of lactic acid in the blood of Kamloops and lake trout following live transportation. Canadian Fish Culturist 18 : 20-27.

Mortality of fish during transportation is a common experience of the fish culturist. Often the cause of death is due to a lowered or complete lack of oxygen or adverse temperature or to a combination of these factors. Another type of mortality appears from one to four days following the transportation. It is contended that various disturbances following muscular activity may constitute the basis for delayed planting mortality in salmonids.

Two year old Kamloops trout and one and one-half year old lake trout were used in this study. Both groups of fish were reared at the Summerland Trout Hatchery, British Columbia. The experiments were carried out at the same hatchery.

During the first hour following the transportation run, the blood lactic acid in lake trout increased from 36.5mg % at the end of the 16th minute to 69.4 mg % at the end of the 64th minute, then decreased precipitously to 14.2 mg % at the end of the 68th minute. Although no measurements were made, the lake trout appeared to be respiring very deeply and rapidly after the transportation run. As regards changes in behaviour, the lake trout did not swim about in the holding trough after the journey, nor did they try to evade capture.

It is concluded that lactic acid from muscular activity may be a significant factor in causing delayed planting mortality in salmonids. It is recommended that fish be held for at least 24 hours at the planting site before being released so that the transported fish may recover sufficiently to be able to swim at their maximum rate in order to cope with predators in the planted waters.

BLACK, R. 1986. 1986 gill net survey on Star Lake, Christie Township. File Report. Ontario Ministry of Natural Resources. Parry Sound, Ontario. 7 p.

During the period of August 12-15, 1986 a gill net survey was conducted on Star Lake, Christie Township. The survey was carried out to determine the status (abundance) of the lake trout population and the relative success of the most recent plantings of both lake trout and rainbow trout. Two gill nets were fished for a total of four net nights of effort. Nine lake trout were caught for a catch-per-unit-of-effort (CUE) of 2.25. Survivors of all plantings of lake trout since 1974 (with the exception of 1977) were present in the catch. Only one rainbow trout was caught for a CUE of 0.25 fish per set. Judging from the weight this fish was a survivor of the 1982 planting.

BLAKE, M. 1987$_a$. Lake trout stocking assessment: Cobre Lake, Sagard Township. File Report. Ontario Ministry of Natural Resources. Blind River, Ontario.

It appears that native lake trout are reproducing on their own. The stocked fish appear stunted and have abnormal gonad development (i.e. all fish at age 8+ were immature). Recommendations from this study include:

- Start stocking with planktivorous stock lake trout and reassess.
- Discontinue stocking with piscivorous stock lake trout.
- If stocking of piscivorous lake trout is continued, the introduction of a deepwater forage fish (i.e. lake herring), may prove beneficial.

BLAKE, M. 1987$_b$. Lake trout stocking assessment: Duborne Lake (Lake of the Mountains), Striker and Coben townships. File Report. Ontario Ministry of Natural Resources. Blind River, Ontario.

Duborne Lake's lake trout are successfully reproducing. In the past year (1986) and this year (1987) 87% of the fish caught had no fin clips (13 out of 15).

Discontinue stocking and assess spawning shoals this fall or next fall (1988). It is interesting to note both lake trout and cisco populations have expanded since the initial lake trout plantings of 1978.

BOWLBY, J., J. M. GUNN and V. A. LIIMATAINEN. 1988. Metals in stocked lake trout (*Salvelinus namaycush*) in lakes near Sudbury, Canada. Water, Air and Soil Pollution 39 : 217-230.

Muscle tissue from stocked lake trout (*Salvelinus namaycush*) from lakes near the smelters at Sudbury, Canada was analyzed for Al, Cu, Hg, Mn, Ni, and Zn. Metals in tissue were not abnormally high compared with fish from lakes farther away from the smelters. Tissue concentrations of Al, Fe, Mn, and Zn declined significantly after stocking. Because metal concentrations were lower in hatchery water than in the study lakes, this decline in tissue metal suggests that diet plays a prominent role in the uptake of these metals in lake trout. Only Hg showed evidence of accumulation to levels that might be harmful for human consumption, and then only in a few older, larger trout. In contrast, tissue Mn and Zn were inversely correlated with trout weight. Fluctuations, independent of age, body weight or time of year, were observed in tissue concentrations of Al, Cu, and Zn. Annual cycles, independent of pH and alkalinity were observed in tissue concentrations of Fe, Hg, Mn, and Ni. Bioaccumulation of metal proved to be an unfounded concern for the rehabilitation of fish populations in lakes near Sudbury.

BRADBURY, G. 1979. Creel survey report: January 1 1979 to September 30 1979. File Report. Leslie M. Frost Natural Resources Centre. Ontario Ministry of Natural Resources. Dorset, Ontario. 54 p.

Native lake trout (*Salvelinus namaycush*), supplemented for several years with hatchery-reared stock, presently occur in 13 oligotrophic lakes managed from the Leslie M. Frost Center. Eight are part of the current lake trout stocking program. A creel census program was initiated between January 1 and September 30, 1979 to evaluate the contribution of stocking to six (Big Hawk, Little Hawk, Raven, Shelborne, St. Nora, Upper Kushog) of these lake trout fisheries.

An estimated total of over 16,000 hours of angling occurred on the six study lakes in 1979. Over 1979, an average of 17.5 hours was required to catch one lake trout in the surveyed lakes. The highest 1979 catch-per-unit-effort (CUE) of 0.128 was recorded on Raven Lake, due to highly successful weekend angling. Over the 1979 season almost 1,800 lake trout were harvested from the six lakes, most in the spring.

The proportion of hatchery-reared lake trout varied from 2.9% (Little Hawk Lake) to 60.0% (Upper Kushog Lake). Hatchery lake trout contributed largely to the creel from St. Nora and Upper Kushog Lakes, indicating a high dependence on stocked trout. This may also explain the split patterns of length and age frequencies indicative of uneven age class distributions of sampled fish from St. Nora and Upper Kushog Lake in 1979. Higher frequencies of age V fish on both lakes reflects stocking efforts from 1975. Fewer stocked fish were caught on the Hawk lakes indicating a greater dependence on angling on natural lake trout populations; a much more normal age class distribution and wider range of sizes was exhibited from the creel on these lakes. It must be noted that not all fish were fin clipped so the percentages of clipped lake trout apparent in the survey are minimal.

Three recommendations are offered for future lake trout stocking projects in these waters:

- Continue the yearling lake trout stocking program, at three year intervals, on all 1979 creel survey lake trout lakes with high priority given to St. Nora and Kushog lakes.
- Attempt to obtain deep-spawning lake trout strains and to stock over known spawning beds.
- Study feasibility of stocking older (i.e., two year old) lake trout in those lakes where natural spawning and current stocking efforts may be inadequate to replace lake trout which are harvested.

BREWER, R. C. 1970. Raquette Lake – Lake trout study: Progress report of 1969 activities. New York State of Department of Conservation. Warrensburg, New York. 23 p.

BRETT, J. R. 1938. Report on White Trout Lake – Cache Lake transfer of trout. Harkness Fisheries Laboratory File Report. Ontario Department of Lands and Forests. Whitney, Ontario. 9 p.

Gill nets were set in White Trout Lake in June, 1938 to obtain lake trout to transfer to Cache Lake. Fish were removed from gill nets and held in pound nets in the outlet stream. Problems were experienced with mortality in gill nets and stress caused by handling and holding procedures. In total, 43 lake trout, 135+ suckers, 21+ lake herring, 9 burbot, 12 yellow perch and 7 shiners were captured. It is believed that only 12 lake trout were transferred to Cache Lake.

BRIDGES, C. H. and L. S. HAMBLY. 1971. A summary of eighteen years of salmonid management at Quabbin Reservoir, Massachusetts. p. 243-254. *In* G. E. Hall [ed.]. Reservoir Fisheries and Limnology. American Fisheries Society Special Publication No. 8. Bethesda, Maryland.

Quabbin is a deep, soft water reservoir with two-thirds of the volume consisting of cold water habitat. Three fisheries management programs have been implemented: lake trout-walleye, 1952-60; lake trout-brown trout-rainbow trout, 1957-65; and lake trout-landlocked salmon, 1965-70. During the initial management program, walleye establishment failed. Lake trout and brown trout were the most successful in the second program. The lake trout and land-locked salmon program shows signs of success. Throughout the three programs, rainbow smelt abundance has fluctuated primarily due to a chemical control program instituted to reduce the population which was interfering with the water supply distribution system.

BROWN, R. 1981. The Charleston Lake winter creel 1980. File Report. Ontario Ministry of Natural Resources. Brockville, Ontario. 4 p. + appendices.

In the spring of 1979 a new method of stocking was introduced on Charleston Lake. The yearling lake trout were loaded onto plastic containers and transported to known spawning sites in the hopes that they will return to the sites to spawn. Prior to this lake trout had been planted off two local docks.

Commencing with the opening of the 1980 lake trout season (February 2 1980) and continuing to the end of the same (February 17 1980), a creel census was conducted on Charleston Lake. The objective of this creel was to obtain information on angling pressure and harvest of lake trout from Charleston Lake. During the survey period, 879 anglers were contacted, producing an observed harvest of 223 lake trout. From pressure counts taken each morning, it was observed that weekend days, in conjunction with fishing derbies, produced an average of 213 persons per day as compared to only 59 persons per day on weekdays. Winter fishing on Charleston Lake is practically non-existent prior to and after the lake trout season. During the lake trout season 99% of the angling pressure is on the lake trout population with very few whitefish, ling or perch being taken while fishing for trout.

BUDD, J. C., F. E. J. FRY and J. B. SMITH. 1968. Survival of marked lake trout in Lake Manitou, Manitoulin Island, Ontario. Journal of the Fisheries Research Board of Canada 25 : 2257-2268.

Lake trout (*Salvelinus namaycush*) (491 in all), planted as yearlings in Lake Manitou in 1952 were tagged at age VII when taken in trap nets during spawn-taking operations. At the same time 259 adult trout of unknown age were also tagged. In spawn-taking operations in subsequent years tag numbers were noted for tagged fish recaptured and the fish returned to the lake after normal spawn-taking. Both groups were estimated to have suffered a decrement of 25% per year. The lake trout planted were given a distinctive fin clip on planting so that comparisons of recaptures of tagged and untagged planted fish permitted estimates of the survival of the total plant. The mean annual mortality rate from the time of planting was also estimated at 25%. Trout planted later appeared to have suffered a similar mortality rate. Observations on planted lake trout of known age indicated that the peak age for first spawning in females was age VI. There is no predation by sea lamprey in Lake Manitou.

BURRIS, K. 1985. A summary of a volunteer creel census on Silent Lake. Fisheries Management Report 1985-09. Ontario Ministry of Natural Resources. Bancroft, Ontario.

A volunteer summer creel census program was conducted on Silent Lake from June to September, 1983. Anglers reported catching 38 lake trout during the creel period which translates into a harvest of 38.76 kg (0.34 kg ha^{-1}). The combined summer and winter lake trout harvest for 1983 of 69.98 kg (0.61 kg ha^{-1}) exceeds the estimated annual allowable sustained yield. It is probable that the lake trout population was overharvested. Hatchery-reared lake trout comprised 47% of the summer harvest and 50% of the winter harvest indicating that stocked fish contributed significantly to angler success. The majority of the lake trout harvested by the summer anglers were immature.

BURRIS, K. and J. BRISBANE. 1985. A summary of an intensive spring creel census on Bay and L'Amable lakes, 1985. Fisheries Management Report 1985-12. Ontario Ministry of Natural Resources. Bancroft, Ontario.

An intensive spring creel census was conducted from May 2 to June 29, 1985 on Bay and L'Amable lakes. On Bay Lake a total of 106 anglers were interviewed. The estimated angling effort for lake trout was 760.7 hours (8.70 hours ha^{-1}). Hatchery-reared fish comprised 17% of the lake trout sampled in the spring indicating that stocked fish are contributing to angler success. On L'Amable Lake, 134 anglers were interviewed. They exerted an estimated 1,224.85 hours (6.71 hours ha^{-1}) of effort. Hatchery-reared fish comprised 37.5% of the spring harvest and 77% of the winter harvest indicating stocked fish contributed significantly to angler success.

BURRIS, K., K. IRWIN and J. BRISBANE. 1985. A summary of an intensive winter creel census on six lakes in the Bancroft district, 1984. Fisheries Management Report 1985-02. Ontario Ministry of Natural Resources. Bancroft, Ontario.

A winter creel census was conducted on six lakes between January 1 and March 30, 1984. Five of the six lakes (Eels, St. Peter, L'Amable, Mephisto and Papineau) provided lake trout fisheries. A total of 1,038 lake trout anglers were interviewed. None of the lake trout sampled on Papineau Lake were hatchery-reared indicating excellent natural recruitment. Hatchery-reared fish contributed significantly to angler success in all other lake trout study lakes. For example, on Mephisto Lake, 83% of the 12 lake trout sampled were of hatchery stock. On Lake St. Peter, 29% of the lake trout sampled were hatchery stock.

BUTLER, G. E. 1950. The lakes and lake fisheries of Manitoba. Transactions of the American Fisheries Society 79 : 18-29.

Manitoba has a large fishery production harvested by commercial fishermen and by anglers. This fishery, yielding annually on an average of over 32,000,000 pounds of all species of fish, is made possible by the 26,789 square miles of lakes and streams which are within the province.

Many factors in the past have resulted in the different types of Manitoba lakes. Lake fisheries have been influenced to some extent by these factors. In recent years the development of commercial fishing, the efficiency of which increases year by year, has been of principal significance in the fisheries. Therefore, laws to regulate fishing in a manner to permit maximum sustained annual catch and policies to improve existing fisheries were possible, have been the object of fishery management in Manitoba.

Introductions of lake trout and other trout species have been made into various "barren lakes" and are mentioned as a means of fishery management in this paper.

CASSELMAN, J. M. 1986. Research on lake trout rehabilitation. File Memorandum. Research Section, Fisheries Branch, Ontario Ministry of Natural Resources. Maple, Ontario. 3 p.

There are several problems that I consider to be important in rehabilitating lake trout stocks. My work in the Haliburton Highlands, with both hatchery and native stocks of lake trout, indicates that there are some important aspects of stocking practices that should be examined.

The current practice is to stock spring yearlings on natural lake trout spawning grounds. This method of stocking presupposes that the young fish imprint on the grounds on which they have been stocked. Stocking spring yearlings on spawning grounds may, in fact, be detrimental. If the fish that are being stocked in the lake are juveniles then they must locate the nursery habitat. For juvenile lake trout this is located in 30-35 m of water. If the juveniles are stocked on the spawning grounds in May, then it is possible that these fish could prey upon the newly hatched fry on the spawning grounds; hence the practice of stocking juveniles on spawning ground may effect increased mortality on naturally recruited fry.

Stocking density should also be examined. Stocking should be conducted based on the density of fish required in the profundal nursery area and on the amount of deepwater nursery available, not on the surface area of the lake. We may currently be overstocking natural populations. If the relative size of the nursery area is small then stocking densities in the nursery may be greatly exaggerated. Since hatchery lake trout are faster growing than most native lake trout then the hatchery fish could prey directly upon the slower growing native fish. Juvenile trout spend up to 4 years in this deep water refugium. The larger, older individuals, if present at high densities, would have a direct effect on younger native fish recruiting to the nursery ground. Native lake trout could be eliminated by stocking practices that produce abnormally high densities of hatchery lake trout in the nursery area. Indeed, if lake trout stocks are to be successfully rehabilitated, then once spawning occurs, stocking densities may need to be greatly reduced to reduce direct competition and predation.

CASSELMAN, J. M. 1987. Experimental netting of South Wildcat Lake to assess the stocking of hatchery lake trout. File Report. Ontario Ministry of Natural Resources. Glenora, Ontario. 9 p.

A lake survey of South Wildcat Lake in 1971 indicated that lake trout were not present nor was there any indication that the lake had ever been stocked with lake trout. It was recommended from this survey that the lake be stocked with lake trout. This occurred in 1972 (2,000 yearlings with right pelvic fin clipped), 1973 (2,400 yearlings with an adipose fin clip), 1974 (7,200 yearlings clip unknown), and 1976 (4,800 unclipped yearlings). A few local fishermen reported confidentially that the lake provided excellent lake trout fishing between 1977-1979.

South Wildcat Lake was chosen for an experiment to determine the relationship (if any) between stocking location and stocking success. On May 6, 1983, 1,000 adipose clipped lake trout were stocked in South Wildcat Lake. Prior to stocking, each fish had also been injected intraperitoneally with "Tetraglo" which is composed of 1 volume of DayGlo pigment in suspension with 2 volumes of Liquamycin. Red marked fish were stocked on what was considered to be the principal spawning shoal; the yellow were stocked on a gravel shore with a gradual drop-off but relatively shallow conditions that were similar to the rearing pond at the Skeleton Lake fish hatchery; the gree were stocked mid-lake in relatively deep and open water. The same was done with fish that were marked with blue; however they were stocked over the deepest basin in the lake.

In July 1983, the lake was gill netted to obtain some information concerning the survival of the stocked lake trout. Six species of fish, including 22 lake trout were captured. A number of unmarked, indigenous lake trout were caught. Fish in their fifth calendar year of lie were from the 1979 year class - this was the first year class of naturally recruited lake trout in South Wildcat Lake.

During November 1986, the lake was again gill netted with gear identical to that used in 1983. One hundred and seventy-nine lake trout were captured. There were a large number of very large lake trout in South Wildcat Lake that did not appear to be fin clipped. There is strong evidence that a high percentage of the fish that were originally introduced into the lake now have fins that have completely regenerated making them virtually impossible to recognize. It appears that clipped fins regenerate on lake trout that are growing rapidly.

From the results of this study, it appears that fish that are stocked in open water in mid-lake over a deep basin have the highest return or survival with the poorest survival from those that are stocked in shallow water onshore. This is strong evidence that stocking location can influence subsequent survival. It is hypothesized that mid-lake plants of yearling lake trout reach the deepwater nursery grounds more quickly than do those stocked on shore, hence are less vulnerable to predation by large fish frequenting the shallows at stocking time.

CERUTTI, D. and D. GILLESPIE. 1965. A second look at the winter fishery of Trout Lake. File Report. Ontario Department of Lands and Forests. Sudbury, Ontario.

Trout Lake, in the townships of Servos, Hoskins, Cherriman and Cosby, has been criticized as being non productive for game fish. A preliminary study of this lake begun during the winter of 1965 was, at least, comparable to what we would expect for the area A total of 328 anglers were recorded. The lake trout catch rate was 29.5 lake trout per hundred angler days. Trout Lake was stocked with lake trout in 1964 but unfortunately we do not have any data prior to this introduction to use as a basis of comparison. It is interesting to note that, since we introduced these lake trout and prepared a preliminary report on the lake's fishing, we have not received any criticism on Trout Lake.

CHALK, S. and D. STOKES. 1978$_a$. Lake trout netting program on Livingstone Lake, Livingstone Township, 1978. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 18 p. + appendices.

A very extensive stocking program was undertaken on Livingstone Lake since 1940. From 1940 to 1965 were introduced but this was discontinued as the lake was considered to be more suitable for lake trout Between 1968 and 1976, a total of 31,900 lake trout have been introduced into Livingstone Lake.

From the small sample of lake trout caught during the netting program, it was found that 44.4% or 4 out of 9 fish had been stocked in previous years. This would seem to indicate that the stocking program is important in sustaining the lake trout fishery. Since the lake receives moderate to heavy fishing pressure in both winter and summer, the stocking program again becomes an important factor in sustaining the lake trout population for anglers. Continued stocking is recommended.

CHALK, S. and D. STOKES. 1978_b. Lake trout netting program on Kimball Lake, Livingstone Township, 1978. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 13 p. + appendices.

An extensive stocking program was undertaken on Kimball Lake from 1940 to 1976. During these years both speckled trout and lake trout were stocked. Speckled trout stocking was discontinued after 1965 as the lake was considered to be incompatible for that species. Since 1971, a total of 23,000 lake trout have been stocked.

During the netting survey the majority of the lake trout caught were between 40 and 50 cm in size. None of the lake trout examined displayed any fin clips. Several lake trout stomachs examined contained yellow perch.

It would seem from the netting that the population of lake trout in Kimball Lake is self-perpetuating as no fish that were caught were marked as being stocked. If the results of the aging of the lake trout samples conform to the fact that these fish caught were not stocked in 1972 or 1976 , when stocked fish were not clipped, then it is the recommendation of the surveyors that stocking of Kemball lake be discontinued.

CHALK, S. and D. STOKES. 1978_c. Lake trout netting program on Camp Lake, Finlayson Township, 1978. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 11 p. + appendices.

A fairly extensive stocking program was undertaking on Camp Lake beginning in 1971 and continuing through to 1976. A total of 26,960 yearling lake trout have been stocked over this period of time. A review of the physical and limnological parameters of the lake indicates that conditions are more than suitable for lake trout.

Based on catches during the netting program, at least 23.8% of the fish caught were stocked. This indicates that some natural reproduction is taking place but that, in itself, it is not sufficient to maintain the fishery at its optimal level. The majority of the lake trout in this lake are fairly small. Only a small fraction of the total population (16.7%) weighed more than 1,000 grams and most (45.2%) were in the 50-150 gram range.

It is the belief of both surveyors that a stocking program must continue if a successful lake trout fishery is to be maintained.

CHAPPLE, D. B. 1981_a. Sweny Lake, Proudfoot Township lake trout assessment program. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 11 p. + appendices.

Sweny Lake sustains very little prolific lake trout population. The chemical and physical properties of the lake are well-suited to the maintenance of a self-reproducing lake trout fishery. The low netting index indicates a high lake trout population and the high percentage of unclipped fish (80%) shows that natural reproduction is definitely taking place.

It is recommended that Sweny Lake be managed as a lake trout fishery. The stocking program should be continued to replace the lake trout that were removed during a contaminant monitoring study in 1979 and the lake trout assessment program in 1980. A summer and winter creel survey should be conducted to monitor fishing pressure, success rates, and harvest of anglers. The number of lake trout stocked could be reduced or eliminated altogether if the creel survey revealed that the number of lake trout harvested each year are being replaced by natural reproduction. The chemical properties of the water should be monitored on a periodic basis, due to the cottage development that is presently taking place on the lake.

CHAPPLE, D. B. 1981$_b$. Bay Lake, Perry Township, lake trout assessment program. File Report. Ontario Ministry of Natural Resources. Bracebridge Ontario. 12 p. + appendices.

The chemical and biological properties of Bay Lake are not suited for sustaining a lake trout population. The low dissolved oxygen levels and the presence of the yellow pickerel population have been fatal to the lake trout fishery. However, natural reproducing populations of yellow pickerel and smallmouth bass do exist in Bay Lake. The high effort-per-unit-catch values for yellow pickerel and smallmouth bass indicates that the size of the population the lake is able to support is restricted by the poor chemical properties of the lake.

It is recommended that Bay Lake should be managed as a yellow pickerel, smallmouth bass fishery and the lake trout stocking program be discontinued.

CHAPPLE, D. B. 1981$_c$. Clear Lake, Oakley Township lake trout assessment program. File Report. Ontario Ministry of Natural Resources. Bracebridge Ontario. 11 p. + appendices.

Clear Lake has excellent physical and chemical characteristics to sustain a healthy lake trout population. The problems associated with the lake trout fishery are lack of suitable spawning beds and competition from lake whitefish. The lake trout population is almost totally dependent on the stocking program for continued existence. The low number of native trout sampled is due to inadequate spawning facilities and/or predation of eggs and developing trout from predatory fish.

It is recommended that Clear Lake be managed as a lake trout fishery and that the stocking program be continued to maintain present trout population. Closer examination of existing spawning beds should be made to determine the problems associated with successful, natural reproduction of the lake trout. This could involve the cleaning off of existing spawning facilities or if feasible the construction of an artificial spawning bed. The lake whitefish population should be reduced by initiating a netting program or encouraging anglers to harvest this readily available fish species. It is recommended that Clear Lake be included in future creel surveys to monitor summer and especially winter fishing pressure. Due to the high number of cottages on the lake the chemical properties of the water should be monitored on a periodic basis.

At the present it is imperative that the stocking program be continued to maintain a lake trout population. This program could be discontinued in the future if found feasible to improve the spawning facilities so that the lake trout could maintain a healthy population by reproducing successfully.

CHAPPLE, D. B. 1981$_d$. Lake trout assessment of Sand Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario.

Sand Lake had a large lake trout (*Salvelinus namaycush*) population. The lake had good chemical and physical properties which allow the lake trout to inhabit over 80% of the lake bottom during late summer. The large number of unclipped lake trout that were stocked in 1972 and 1974 made it difficult to determine the contribution of the stocking program to the lake trout fishery. Recommendations included the aging of the scale samples, observing the lake trout on spawning beds and improving these areas to increase natural reproduction.

CHAPPLE, D. B. 1981$_e$. Lake trout assessment of Bigwind Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 40 p.

Bigwind Lake has good water quality properties for supporting a trout fishery. The lake contains a stocked lake trout (*Salvelinus namaycush*) and rainbow trout (*Salmo gairdneri*) fishery and a small native brook trout (*Salvelinus fontinalis*) population. It was concluded that maintaining the stocking of lake trout and rainbow trout is necessary to sustain a sport fishery.

CHAPPLE, D. B. 1982$_a$. Lake trout assessment of Proudfoot Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario.

Proudfoot Lake has a small lake trout (*Salvelinus namaycush*) and brook trout (*S. fontinalis*) population. The lake has good oligotrophic properties for lake trout. The small lake trout population is a result of unsuccessful natural reproduction, limited stocking, high angler harvest and competition from lake herring. Recommendations include the improvement of spawning beds, the stocking of lake trout, a reduction in the harvest of lake trout and the retention of the oligotrophic properties of the lake.

CHAPPLE, D. B. 1982$_b$. Lake trout assessment of Pevensey Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario.

Pevensey Lake has a small lake trout (*Salvelinus namaycush*) and a very small brook trout (*S. fontinalis*) population. The lake has good physical and limnological properties for lake trout. The high percentage of stocked lake trout that were sampled indicated limited natural reproduction. Recommendations include the continued stocking of lake trout, the improvement of spawning beds, the elimination of winter angling and the monitoring of dissolved oxygen and chlorophyll *a*.

CHAPPLE, D. B. 1982$_c$. Lake trout assessment of Oliphant Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario.

Oliphant Lake has a large native self-reproducing lake trout (*Salvelinus namaycush*) population. The lake has good physical and oligotrophic properties for lake trout. The large lake trout population is a result of limited road access, the lack of cottage development and successful reproduction. Recommendations include the elimination of the stocking of lake trout, controlling the harvest of lake trout and retaining the oligotrophic properties of the lake.

CHAPPLE, D. B. 1982$_d$. Lake trout assessment of Bear Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 33 p.

The netting index indicated that Bear Lake had a large lake trout (*Salvelinus namaycush*) and a smallmouth bass (*Micropterus dolomieui*) population. The lake had good coldwater habitat for lake trout. The lake appeared to rely upon a regular stocking program for the maintenance of the lake trout fishery.

CHAPPLE, D. B. 1983$_a$. Lake trout assessment of Clearwater Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario.

Clearwater Lake had a moderate to large native self-reproducing lake trout (*Salvelinus namaycush*) population. The lake had good physical and limnological properties for lake trout. The healthy lake trout fishery is a result of low angler harvest, good oligotrophic features and successful natural reproduction. Recommendations included the elimination of the stocking of lake trout, the implementation of a voluntary creel survey and the retention of the oligotrophic properties of the lake.

CHAPPLE, D. B. 1983$_b$. Lake trout assessment of Buck Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario.

Buck lake has a moderate to large native lake trout (*Salvelinus namaycush*) population. The lake had suitable physical and limnological properties to support a lake trout fishery with limited potential. The log crib dam at the outlet should be repaired to maintain fall water levels which should increase the success of natural reproduction. Lake trout should not be stocked in Buck Lake.

CHAPPLE, D. B. 1984$_a$. Lake trout assessment of Fifteen Mile Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 37 p.

Fifteen Mile Lake has a well established lake trout (*Salvelinus namaycush*) population due to the introduction of lake trout in 1976 and subsequent plantings in 1978 and 1980. The lake has good physical and limnological properties for lake trout. The good sport fishery is a result of the stocking of lake trout, an adequate food supply and the lack of competition from other coldwater fish species. Recommendations include the continued stocking of fin clipped lake trout, the implementation of a fall spawning bed survey, a reduction in the harvest of lake trout and the preservation of the oligotrophic properties of the lake.

CHAPPLE, D. B. 1984$_b$. Lake trout assessment of Hungry Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 24 p.

Hungry Lake, Bethune Township, is a small (14.1 ha) oligotrophic lake. A total of 7,250 brook trout, 2,800 lake trout and 300 rainbow trout have been stocked in Hungry Lake since 1963. The lake currently has a moderate to large brook trout population.

The catches of lake trout dropped off dramatically by 1975 and have been low since that time. The owner of the hunt camp also stated that none of the clipped lake trout planted in 1975 or the rainbow trout stocked in 1982 have been caught by members of the club. The netting data and creel information indicated that lake trout did not contribute significantly to the sport fishery. The physical and limnological parameters (e.g., hypolimnetic dissolved oxygen) of the lake were not suitable for lake trout.

Recommendations include improvements to the brook trout spawning beds, elimination of the stocking program and prohibition of the use of live bait.

CHAPPLE, D. B. 1984$_c$. Lake trout assessment of Bacon Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 22 p. + appendices.

Bacon Lake has a small lake trout (*Salvelinus namaycush*) population. The lake has poor physical and chemical properties to support a lake trout fishery. Road access to the lake in on private land and restricted to the public. The netting data indicated that limited natural reproduction occurs in Bacon Lake. The stocking of lake trout should be discontinued.

CHARLTON, W. H. 1967. Fisheries management plans for Otty Lake, Lanark County. File Memorandum. Ontario Department of Lands and Forests. Kemptville, Ontario. 4 p.

During 1926, 15,000 lake trout were first introduced to Otty Lake. Stocking was continued with 1,000 fish in 1951; 2,000 fish in 1960; 1,000 fish in 1961; and 1,000 fish in 1962. No lake trout were netted in a September, 1967 survey but this does not necessarily mean that they are not now in the lake. This, along with the fact that no lake trout have been angled, only indicates that stocking has not been successful to date. During summer stratification, lake trout prefer deep, cooler waters of the lake. Chemical analysis of Otty Lake reveals that, at 50 feet, the water temperature is suitable but little or no dissolved oxygen is present. In summary, we feel that no future planting of lake trout should be conducted.

CHELEY, H. 1970. 1970 winter creel census on Lake Manitou. File Report. Ontario Department of Lands and Forests. Sudbury, Ontario. 8 p.

During a winter creel census on Lake Manitou, a total of 124 hatchery-reared lake trout were identified in the catch (N=495). Three hundred and seventy-one fish (74.9%) were unclipped trout believed to be wild fish. Several age classes of stocked fish were evident including four fish from a 1959 stocking.

It is recommended that stocking of yearlings be continued. A study should be made to determine what amount would be in line with the increasing exploitation of lake trout in Lake Manitou.

CHENEY, A. N. 1885. Does transplanting affect the food or game qualities of certain fishes? Transactions of the American Fisheries Society 14 : 55-59

I have seen that whenever the New York lakes containing a remnant of lake trout have had a contribution of lake trout fry from the Great Lakes, the addition or deposit has increased the average size of the trout in such waters. I do not think that it was coupled with or contingent upon an additional supply of food. I have closely watched this improvement in the trout of Lake George, New York. Before the lake was restocked by the state the trout were very poor and small and because of the gradual taper from their heads to their tails were called "wedges" by the fishermen. Every spring during the trolling season quantities of small whitefish were seen at the surface of the water, so the lake was not entirely barren of food for the native trout. Five years later, after the state made the first deposit of trout fry, it planted some whitefish for food. There was a marked improvement in the trout almost from the first planting of fry and each year since the average in size of the catch has been larger and the condition of trout better. Does not the fresh blood or out-cross improve the natives and leaven the whole? I am satisfied that fish in alien waters improve in food and game qualities only when they find better feed or better waters which causes a more vigorous conditions which is the gameness desired by anglers.

CHEVALIER, J. 1977. Large yearling lake trout stocking assessment study in the northeastern region. Manuscript Report. Ontario Ministry of Natural Resources. Sudbury, Ontario. 13 p.

The northeastern administrative region of the Ontario Ministry of Natural Resources has identified 643 lake trout (*Salvelinus namaycush*) lakes within its boundaries. The major strategy during the past several decades for "problem" lakes has been to supplement the native lake trout population with hatchery-reared fish. In 1976, 83 lakes within the region were stocked with this objective in mind. Although these types of stockings have been inadequately assessed, the general consensus of fisheries managers in the region is that they have been relatively unsuccessful. Consequently, in an attempt to improve the success of supplemental stocking, fisheries management have recently been requesting larger yearling lake trout: 20 or less per pound. Prior to requesting the hatchery system to produce these fish on a mass scale, it was decided that a thorough study of stocking success be conducted in a set of "type" lakes. This plan is an attempt to record the methodology and procedures prior to commencement of the study.

Briefly, highlights of the program may be itemized as follows:

- Candidate lakes were subjectively assigned a rating of good-fair-poor according to the status of their lake trout population. Each of the categories had two replicates.
- There were three annual plantings (1977, 1978, 1979) in the set of study lakes.
- Size of stocked yearling lake trout averaged 15-25 fish per pound.
- Stocking rates were 5 fish per surface acre.
- All planted fish bore an adipose fin clip.
- Swedish monofilament gill nets (mesh sizes 1, 1½, 2, 2½ and 3 inch) were used to target age II lake trout.
- Assessment netting would be conducted between June and August when lake trout were concentrated at or below the thermocline.
- Objective is to capture and sample 50 lake trout in the size range of 6-12 inches (15-30 cm).
- Assessment effort was a minimum of 10 foot-days of netting per surface acre.
- Gill nets should be lifted every twelve hours (morning and night).

CHIOTTI, T. L. 1980. A strategic fisheries management plan for Seneca Lake. Bureau of Fisheries, New York State Department of Environmental Conservation. Albany, New York. 45 p.

The primary purpose of this plan is to develop fisheries management strategies to protect and improve the fisheries resource of Seneca Lake in order to meet the needs of anglers and to provide economic and other benefits to the general public.

Seneca Lake is the largest of the Finger Lakes, occupying 43,343 acres. Seneca Lake has traditionally had a large lake trout population which supported both commercial and recreational fisheries. Lake trout stocking records dating back to 1927 show that over 175,000 fish were stocked annually in Seneca Lake. It was recently learned that this action may have been responsible for the large lake trout population, because a decrease in stocking beginning in 1973 coincided with a present population decline.

The lake trout fishery has suffered a recent decline as a result of the combined effects of reduced stocking levels beginning in 1973, decreased contribution of natural reproduction to the population and fishery, and an increase in sea lamprey predation resulting from colonization of Keuka Lake outlet. The present lake trout population is smaller than desired to maintain excellence in lake trout fishing. As natural reproduction currently (1979) supports only 15% of the population, a maintenance stocking program is imperative to support both the fishery and brood stock capabilities of the lake. Both yearling and fall fingerling fish will be stocked to minimize the risk of year class failures that could occur if only yearling plantings were utilized. Experience in the 1970s showed that two successive year class failures could possibly have been averted by stocking both yearlings and fall fingerlings.

Stocking recommendations have been increased from 28,000 to 45,000 yearling fish in 1979. In addition, a stocking policy change was made in 1979 that called for stocking 36,000 yearling lake trout and 72,000 fall fingerling lake trout beginning in 1980. At this stocking level and with experimental sea lamprey control it is expected that the fishery will begin to recover in 1984 and attain a level similar to that of the 1950s and 1960s by 1987.

CLARK, C. 1972. 1971 creel census report for Rideau Lake. File Report. Ontario Ministry of Natural Resources. Kemptville, Ontario.

Rideau Lake has been stocked with lake trout since at least 1916. In the last four years (1968-1971) stocking has involved the release of between 12-15,000 fin-clipped yearling lake trout. During the 1971 creel census, 9 of 51(17.6%) angled lake trout had right ventral fin clips. These lake trout had been stocked in the spring of 1968. Most were 16-18 inches long when caught.

CLAYTOR, R. R., A. MATHERS and N. G. MacLEAN. 1985. The winter sport fisheries of Big Clear, Big Rideau, Big Salmon, Charleston and Devil lakes. Rideau Lakes Fisheries Assessment Unit Report No. 13. Ontario Ministry of Natural Resources. Sharbot Lake, Ontario.

In February 1984, the Rideau Lakes Fisheries Assessment Unit conducted a creel census on Big Clear, Big Rideau, Big Salmon, Charleston and Devil lakes.

The census was part of a long-term program designed to provide sport fishery information on these lake trout waters for trend-through-time analysis. Information requirements included:

- Estimates of catch, harvest, effort, and angler success rates,
- Length, weight and age structures of the harvest,
- Contribution of hatchery origin fish to the harvest,
- Fishing methods, and
- User group characteristics.

Results were interpreted in light of several indices of over-exploitation (ie., relative yield index, total mortality, Abrosov index and growth). These indices did not allow any clear cut interpretation, however, the lake trout populations in all lakes showed signs of over-exploitation.

Increases in catch-per-unit-of-effort (CUE) and yield indicate that the lake trout fishery in Big Clear Lake is recovering from prior over-exploitation. However, the continued decline of the Abrosov index and the increase in angler effort suggest that the increase will be short lived.

In Big Rideau Lake, trends in yield and CUE indicate that the lake trout fishery is relatively stable at present stocking rates and is in one of the intermediate stages of development.

The decline in mortality and the increases in yield and CUE suggest that the lake trout population in Big Salmon Lake is recovering from past over-exploitation, However it is difficult to assess this population without a better understanding of the summer fishery.

In Charleston Lake the lake trout fishery seems to be stable at present stocking and effort rates, however, apparent declines in CUE warrant close monitoring.

The summer fishery is very important in Devil Lake, however the winter data seems to indicate that the trout population is in the late intermediate stage of development. Data from Big Clear and Devil lakes showed that lake trout caught on herring bait were significantly larger than trout caught on other baits. The majority of anglers were local residents of Ontario.

COATES, D. 1997. Codes of practice for the stocking and introduction of fish. *In* I. G. Cowx [ed.]. Stocking and Introduction of Fish. Fishing News Books. Blackwell Science. Oxford.

COOMBS. 2000. Spring littoral index netting (SLIN) results for Charleston Lake. Unpublished data. Ontario Ministry of Natural Resources. Kemptville, Ontario.

Lake trout assessment, involving spring littoral index netting (SLIN) was conducted on Charleston Lake in late April-early May, 2000. A total of 68 lake trout were captured. Only six fish (8.8%) were unclipped while the remainder (62 trout; 91.2%) bore a fin clip indicative of their hatchery origin.

COWX, I. G. 1994. Stocking strategies. Fisheries Management and Ecology 1 : 15-30.

Stocking, transfer and introduction of fish are commonly used to mitigate loss of stocks, enhance recreational or commercial catches, restore fisheries or to create new fisheries. However, many stocking programs are carried out without definition or objectives or evaluation of the potential or actual success of the exercise. This paper describes a strategic approach to stocking aimed at maximizing the potential benefits. A protocol is discussed which review factors such as source of fish, stocking density, age and size of fish at stocking, timing of stocking and mechanism of stocking. The potential genetic, ecological and environmental impacts of stocking are described.

The first step with any stock improvement activity must involve the clarification of management objectives. Where the limiting factor(s) can be isolated, efforts should be made to resolve the problems before resorting to stocking. The fishery may then recover without stocking. Stocking generally does not tend to improve the catches in waters where there is adequate natural recruitment.

When evaluating stocking as a possible management tool, the relative benefits and cost of all options should be considered. The "do nothing" option should not be disregarded but should be considered as fully as any of the other options under discussion, despite possible public pressure to stock.

Enhancement stocking is the principal method used to maintain or improve stocks where production is actually or perceived to be less than the waterbody could potentially sustain but where reasons for the poor stocks cannot be identified. If production is already limited or driven by natural populations cycles, it is unlikely that stocking will have a beneficial long term effect.

One component of stocking exercises which has been largely neglected is an evaluation of the program and an audit of the degree of success of the work. Such evaluations should be considered an integral part of the program and stocking should not be approved without building in a post-project evaluation.

A series of guidelines should be produced for all species which are stocked or introduced clearly defining the most effective protocol for deciding whether stocking should take place, how it should be implemented and the potential impacts of such activities.

CROSSMAN, E. J. 1995. Introduction of the lake trout (*Salvelinus namaycush*) in areas outside its native distribution: A review. Journal of Great Lakes Research 21(Supplement 1) : 17-29.

A survey revealed that there have been introductions of the lake trout in 15 countries around the world. Most of these were in Canada and the United States. Of those off the North American continent, three have failed, four have established reproducing populations, and six require regular stocking. Outside the indigenous distribution in North America, four provinces and fifteen states have introduced the species with varied results. It would appear that reproducing, introduced populations require environments similar to those in the native range of the species, and are most successful if established with larger individuals.

CRONIN, P. J. 1979. Feasibility of lake trout (*Salvelinus namaycush*) introduction into Grand Lake, New Brunswick. M. Sc. Thesis, University of New Brunswick. Fredericton, New Brunswick. 187 p.

CUENCO, M. L., T. W. H. BACKMAN and P. R. MUNDY. 1993. The use of supplementation to aid in natural stock restoration. p. 269-294. *In* J. G. Cloud and G. H. Thorgaard [eds.]. Genetic Conservation of Salmonid Fishes. Plenum Publishing. New York, New York.

CUERRIER, J. –P. 1952. Transfer of anaesthetized adult lake trout by means of an aircraft. Canadian Fish Culturist 13 : 1-4.

For stocking and restocking bodies of water, fish eggs, fry and fingerlings have been moved by a variety of means. Pack horses, packs on men's backs, railroads, steamship and aircraft have all be utilized. Aircraft, for example, have been extensively used in the Province of Québec and in the states of New York and California. In the case of adult living fish, trucks and railroad cars equipped with water-filled tanks have been used most frequently as a means of transportation.

The Province of Manitoba transferred by air from Clearwater Lake to Cormorant Lake 1,100 and 1,000 adult lake trout in 1947 and 1948, respectively. These fish were moved over a distance of approximately 25 miles in Norseman and Husky aircraft equipped with water-filled tanks. These trips necessitated 10 or 11 trips. An additional transfer of 1,000 adult lake trout was made in 1948 from Clearwater Lake to Manistikwan Lake; the distance between the two lakes is 50 air miles.

In seven flights, 1,231 adult lake trout were transferred from Wassegam Lake to Crean Lake in the fall of 1951. Of this number 1,110 trout recovered and were released. Losses amounted to 10% of the fish moved. Total loss of fish caught in Wassegam Lake amounted to approximately 26% but this could be reduced as a result of experience in any such operation in the future.

DEARY ENVIRONMENTAL CONSULTANTS. 1990. Summary report for lake trout (*Salvelinus namaycush*) assessment of thirteen lakes in the Parry Sound district. Report prepared for the Ontario Ministry of Natural Resources. Bracebridge, Ontario. 28 p.

Gill netting surveys were conducted in thirteen lakes in the Parry Sound district between 28 June and 28 August 1989 in an effort to determine abundance indices for stocked and natural lake trout (*Salvelinus namaycush*) populations. A total of 128 gill nets were set resulting in a total catch of 118 lake trout, 69 lake whitefish (*Coregonus clupeaformis*), 1,452 cisco (*Coregonus artedii*) plus 161 other incidental fish. The best estimate of the mean catch per unit effort (CUE) for lake trout ranged from 0.19 to 1.52 for Flaxman and Little Sequin lakes respectively. The mean round weight for lake trout ranged from 568.8 gm in Three Legged Lake to 3337.5 gm in Sollman Lake. Lake trout from Spider Lake were in the best condition (C=1.39). Condition factors for lake trout from the remainder of the study lakes ranged from 0.92 to 1.19.

DESJARDINE, R. L. 1979. Fall netting in Lake Simcoe for lake trout and lake whitefish, 1978. Lake Simcoe Fisheries Assessment Unit Manuscript Report No. 79-5. Ontario Ministry of Natural Resources. Sutton, Ontario. 28 p.

Sampling of fall spawning populations of lake trout (*Salvelinus namaycush*) and lake whitefish (*Coregonus clupeaformis*) is a regular component of the fisheries research program on Lake Simcoe. Three trap nets were operated at Georgina, Thorah and Strawberry Islands for 125 net days between October 13 and November 29, 1978. A total of 477 lake trout were caught of which 89.1% were of hatchery origin Catches of lake trout of Manitoba stock origin predominated early in the spawning run with their numbers peaking 20.8 days after October 1 compared to 24.0 days for the rest of the population.

DESJARDINE, R. L and J. N. LAWRENCE. 1979. Winter creel census on Lake Simcoe. Lake Simcoe Fisheries Assessment Unit Report 79-4. Ontario Ministry of Natural Resources. Sutton, Ontario.

During the winter of 1979, it was estimated from creel census results that 98,604 anglers spent 583,270 hours to catch 5,329 lake trout (*Salvelinus namaycush*). Anglers continued to harvest old lake whitefish from the residual population and hatchery-reared fish predominated the lake trout catches (76.4%)

DEYNE, G. 1990$_a$. Fish stocking guidelines for the Algonquin Region. Ontario Ministry of Natural Resources. Huntsville, Ontario. 11 p.

These guidelines attempt to further refine stocking decisions with respect to the suitability of waters. The criteria for stocking salmonids are based on the percentage of natural recruitment, available habitat (temperature and oxygen profiles) and resident fish communities.

The waterbody should have greater than 20% of the lake by volume > 4 ppm dissolved oxygen and < 15° C. Notwithstanding these criteria, experimental stocking may be conducted below this value for three successive plants with assessment. Standardized assessment of stocked lakes with less than 20% lake trout habitat should help to provide the information necessary to refine the relationship between stocking success and available habitat.

To minimize the risks associated with stocking on native lake trout populations, it is recommended that the stocking of fish from a non-local source be avoided when natural fish represent 50% or more of a representative sample from a creel or netting of a stocked waterbody. The selection of a 50% or greater natural component as a cut-off value is subjective. It would be considerably easier to justify a lower percent natural component (e.g., 25%) given the potential consequences of stocking. Consideration should also be given to the age composition of natural and stocked lake trout, from netting assessment, as an indicator of trends in natural recruitment. A natural component of less than 50% comprised primarily of young lake trout would indicate potential recovery and therefore stocking should be discontinued. The age composition of stocked and native fish in a creel sample is more difficult to evaluate given the potential differences in catchability and compensating effects related to exploitation. Management strategies for unstocked waters would be directed at harvest control and habitat protection and rehabilitation if required.

DEYNE, G. 1990$_b$. Algonquin Region guidelines for pre- and post- stocking assessment. Draft guidelines. Ontario Ministry of Natural Resources. Huntsville, Ontario. 10 p.

These draft guidelines have been prepared to establish consistency in sampling procedure for inland waters for pre- and post- stocking assessment of salmonids within Algonquin Region. Consistency in the sampling procedure will allow for comparative results between districts to achieve stocking assessment priorities with increased efficiency.

The sampling objective for lake trout is the capture of age 2+ year old fish for the purpose of determining a catch-per-effort (CUE) index and establishing the percentage of clipped to unclipped fish. Sampling gear consists of three green monofilament gill nets comprised of 3.8, 5.1 and 6.4 cm mesh. Netting sites are selected randomly based on the designation of shoreline sectors. Netting occurs during daylight hours after ice melt and before the temperature reaches 13° C. Nets are left to fish for 30 minutes. There is a minimum sampling effort of 20 lake trout or 40 net sets.

DIEBOLT, J. 1982. Lake Manitou winter creel census. File Report. Ontario Ministry of Natural Resources. Espanola, Ontario.

A total of 1,716 anglers exerted 3,453 hours to catch 682 lake trout from Lake Manitou in the winter of 1982. Fourteen lake trout (2.1%) of the catch were assumed to be native lake trout.

DOAN, K. H. 1937. Report of a season's angling on Cache Lake, summer 1937. Ontario Fisheries Research Laboratory, University of Toronto. Toronto, Ontario. 10 p.

This report has been compiled for the information of those who fished in Cache Lake, Algonquin Park, during the past summer and embodies the data collected from individual census card returns. The season's catch of lake trout has been estimated at about 260 fish. Fishing was most intensive during the midsummer months and the larger proportion of the season's catch was taken during that period. Nearly 60% of the fish recorded by anglers were 14 inches or less in length.

During the first week of June, a transfer was made of 52 adult lake trout to Cache Lake. The fish were all liberated in the north end of the lake. One-quarter of the tagged trout were caught within three months of planting.

In order to maintain an intense fishery which draws so largely upon small fish which do not get a chance to spawn more than once or perhaps twice, it might be advisable to augment the natural reproduction by the addition of 20,000 lake trout fingerlings every two years. The value of planting can be determined only by a constant check on the results as shown in anglers' catches by a creel census.

DOAN, K. H. and W. A. KENNEDY. 1937. A transfer of lake trout from Happy Isle Lake to Cache Lake, Algonquin Park, Ontario. Ontario Fish Research Laboratory, University of Toronto. Toronto, Ontario. 6 p.

This paper reports the initial stages of an experiment to determine the advisability and value of transferring adult lake trout (*Salvelinus namaycush*) from one lake to another for stocking purposes and to develop a technique of transfer.

Live fish were procured from Happy Isle Lake, situated approximately at the center of Algonquin Park, between June 2 and June 8, 1937. Trolling with copper line and Archer spinners was used as a technique to supplement catches from hoop nets. The captured fish were kept alive in a box attached to a raft. Fish were removed daily by aeroplane equipped with galvanized tanks. Best results were obtained by providing ice and using one pail of water per fish. The average time that the fish remained in the tank was 25 minutes. It was found that 10 two pound fish could be safely carried on one trip; more than ten fish resulted in considerable mortality.

At Cache Lake, the fish were taken from the aeroplane and placed in a live box. When the fish were in poor condition, ice was used in the live box in order to bring about a gradual transition to lake temperature. A small aluminum tag bearing a serial number was attached to the anal fin of each trout.

Fifty-two adult lake trout and seven adult speckled trout have been added to the Cache Lake fish population as a result of the transfer.

DOLSON, N. 1989. Background information on Sudbury area lake trout lakes: A rehabilitation plan. Ontario Ministry of Natural Resources. Sudbury, Ontario. 102 p.

Changes in pH of lake trout lakes not included in this rehabilitation plan are presented in Appendix II. The pH improved in all but three of the lakes. The large pH increase in Bowland Lake is due to liming in 1983.

In order to evaluate the success of rehabilitation efforts, it is important that stocked fish be distinguishable from native ones. Stocking and recruitment assessments are essential to monitoring the success of rehabilitation efforts, therefore it is imperative that stocked fish are fin-clipped. Ideally, all lake trout planted every year would be marked by clipping the adipose fin. Using the same clip every year will eliminate any effects that differential clipping may have on survival

Some lakes that have received hatchery trout in recent years could be producing their own recruits. But recruitment cannot be confirmed unless future stocks are fin-clipped or unless stocking is discontinued for several years prior to assessment. Fin clipping is essential to follow-up assessments in lake rehabilitation for estimating stock mortality and confirming recruitment.

Many factors can affect the survival and growth of lake trout. Some studies have concluded that the survival of stocked lake trout may be limited by intraspecific competition with previously stocked lake trout. This is an important factor to consider for those lakes where a naturally reproducing population is desired. Stocking in alternate years may minimize losses resulting from intraspecific competition.

When using lake trout ranging in age from 25 to 36 months (from time of fertilization). Some have observed that survival of stocked lake trout was not related to stocking season. It has been found that 16-month old lake trout (weighing from 18 to 25 g) contributed significantly to the size of lake trout year-classes in the eight lakes included in their study.

The rehabilitation options recommended in this report comply with the strategies proposed in the Sudbury District's Fisheries Management Plan. Some rehabilitation options are dependent on lake survey, assessment or water chemistry results, therefore it is not feasible to calculate the quantity of fish required for stocking (for all forty-one lakes) or to categorize the lakes according to rehabilitation options.

Clipped lake trout should be planted at age 1+ (at a rate of 12 fish/hectare) for those lakes were a self-sustained lake trout fishery is desired. Clipping is not as important in put-grow-take fisheries but could be beneficial in subsequent years if water quality improves and recruitment is in question. Brook trout and splake are alternate species to consider planting in lake trout lakes where lake trout are extinct or recruitment has failed.

DOMINION OF CANADA. 1892. Fisheries statements and inspectors reports for the year 1891. Department of Fisheries. Ottawa, Ontario.

This is the report of the officer in charge of the Ottawa hatchery for 1891. A total of 1.50 million salmon trout ova were transferred in from the Newcastle hatchery. Of this total, 1,380,000 salmon trout fry were stocked in eleven Ontario lakes and nine Québec lakes. Ontario lakes stocked included Big Rideau Lake (265,000 fry), Charleston Lake (225,000 fry), Sharbot Lake (120,000 fry), Bass Lake (45,000 fry) and Little Lake (45,000 fry). These waters seem well adapted for salmon trout and are also convenient to reach for planting.

DOSSER, S. 1988. Spawning site observations and documentation for eight lake trout lakes in the Bancroft district, 1987. Fisheries Management Report 1988-01. Ontario Ministry of Natural Resources. Bancroft, Ontario.

The majority of effort this year concentrated on four lakes which were suspected of having depleted lake trout populations: Baptiste, Centre, Limestone and Purdy. Purdy Lake was stocked with adults in 1986 and this year's observations provide no evidence that those fish have started to spawn. At this time, they are simply providing a put-and-take fishery. The Limestone Lake fishery is apparently maintained through stocking. The high number of hatchery clipped fish observed on the spawning beds suggests that the stocked fish are reproducing. On Limestone and Purdy lakes, 71% of the trout were stocked fish. The spawning observations on Baptiste and Centre lakes and the poor netting results obtained from the assessment conducted in the spring of 1987 are mutually supported and suggest that lake trout stocks are depleted.

DOSSER, S. 1989. Spawning site observations and documentation for four lake trout lakes in the Bancroft district. Fisheries Management Report 1989-04. Ontario Ministry of Natural Resources. Bancroft, Ontario. 32 p.

Lake trout (*Salvelinus namaycush*) spawning bed observations were conducted from September 29 to November 1, 1988 on four Bancroft district lakes. Lake trout were observed on 21 of 53 potential spawning beds. A total of 103 lake trout were netted and released; 48 from Anstruther, 44 from Wollaston, 10 from Buzzard and 1 from Diamond. Only 3% were hatchery stock.

DOSSER, S. and J. BRISBANE. 1987. Spawning site observations and documentation for six lake trout lakes in the Bancroft district, 1986. Fisheries Management Report 1987-03. Ontario Ministry of Natural Resources. Bancroft, Ontario.

From September 22 to November 30, 1986 lake trout spawning bed observations were conducted on 30 potential spawning sites in six lakes in the Bancroft district. Lake trout were observed on Bay, Cashel, Limerick and Jamieson lakes, however none were documented on LaVallee and Robinson lakes. Forty-one lake trout were sampled for physical data; of these, 36.6% had fin clips indicating they were hatchery-reared fish.

DUNLOP, W. I. and C. J. BRADY. 1995. What happens when you stop stocking? Responses of a native lake trout (*Salvelinus namaycush*) fishery to cessation of supplemental stocking. p. 135. *In* Program and Abstracts of the 15th International Symposium of the North American Lake Management Society, Toronto, Ontario.

Traditionally, fish stocking in Ontario has been undertaken for a variety of fisheries management purposes including rehabilitation of degraded stocks, range extension, put-grow-take fisheries and supplemental stocking over natural populations. Recent studies have shown that supplemental stocking of hatchery fish into lakes with native populations can have a number of adverse effects. Despite this, there is still a perception that supplemental stocking is necessary to maintain acceptable angler success rates and harvest.

We present winter creel survey data from two southcentral Ontario lakes where stocking has been discontinued. Lake Rosseau is a large (6295 ha) oligotrophic lake trout lake, located in the District Municipality of Muskoka. It was stocked with lake trout from 1942 until 1990. The Meach lakes are two small (72 ha total) interconnected natural brook trout lakes located in the Haliburton Highlands. The lakes were stocked with yearling brook trout from 1961 to 1986.

Since stocking ceased, both trout populations have exhibited strong incoming year classes of young fish, possibly due to reduced competition or predation from stocked yearlings. On Lake Rosseau angler success rates (CPUE) are double and total catch of lake trout is higher than during the period of stocking. On the Meach lakes, after an initial decline both angler success (CPUE) and total catch of brook trout is equal to or better than before stocking ceased. We expect harvest and yield to increase also as the strong incoming year classes are fully recruited to the fisheries.

DUNLOP, W. and C. BRADY. 1997. Responses of two native trout fisheries to cessation of supplemental stocking. *In* P. MacMahon [ed.]. Northwest Science and Technology Stocking Workshop Proceedings WP-003, Ontario Ministry of Natural Resources, Thunder Bay, Ontario.

In recent years there has been considerable debate about the relative benefits and detrimental effects of stocking. In Ontario, management recommendations from Lake Trout Synthesis suggest that, while stocking for rehabilitative, range extension and put-grow-take purposes should be permitted where they are an appropriate management tool, the "supplemental" stocking of lake trout (*Salvelinus namaycush*) not be permitted. This is because of the many possible adverse effects of stocking hatchery lake trout into lakes with native populations.

We present a case study from Lake Rosseau, Ontario where lake trout stocking was discontinued. Effort was increasing at the time stocking was stopped and continued to rise for one year before levelling off. Trends in harvest and yield have generally followed the effort trend but catch and catch rates have increased since stocking was discontinued. Catch rates in fact doubled. Harvest did not increase accordingly because anglers released large numbers of small lake trout. These fish seem to represent strong incoming year classes which may have resulted from reduced competition since the cessation of yearling stocking.

DURANT, G., M. D. GOLDSTEIN, G. J. F. HEIGENHAUSER, R. F. LAUFF, C. L. MILLIGAN, C. J. A. MITTON, E. K. POSTLEWAITE, Y. WANG, M. P. WILKIE, C. M. WOOD and D. G. McDONALD. Undated. The effects of very low rearing velocities on physiological performance of lake charr (*Salvelinus namaycush*) and lake charr backcross (*S. fontinalis* x *S. namaycush*). File Report. Ontario Ministry of Natural Resources. Toronto, Ontario. 38 p.

Lake charr (LC, Lake Manitou strain) and lake charr backcross (BX, Lake Manitou strain x splake) juveniles were reared for 4 months at 9 + 1°C and nominal velocities of 0.2, 0.7, or 2.0 cm/sec (0.03 – 0.16 body lengths/sec at start of experiment). Fish were reared in 12 raceways, 6 velocity treatments, ~ 10,000 fish per raceway. Velocities were controlled in each raceway by adjusting water depth and flow. Growth was exponential in both strains, with body weights increasing by more than 2 fold (from ~ 19 g) and length increasing by 3-4 cm (from ~ 12 cm at start). There were only minor effects of velocity on growth and condition factor in both strains. There were, however, significant effects of rearing velocity on a variety of physiological parameters Higher rearing velocities increased plasma Cl^- and decreased total plasma amino acids in LC (with no effect on Na^+, glucose and cortisol), depressed urea secretion, increased whole body glycogen content and bone mass (without affecting protein, lactate, and lipid content), improved burst swimming performance in BX (but not LC), improved performance in LC in an 8 hour confinement stress procedure, but had no effect on U_{crit} (maximum sustainable swimming speed) in either strain. This study shows that rearing velocities, well below those normally thought required to produce training effects in salmonids (1 – 2BL/sec), but which are achievable in a typical hatchery environment, can produce significant physiological effects which, in turn, may influence post-stocking survival.

EATON, E. H. 1928. The Finger Lakes fish problem. p. 40-83. *In* A Biological Survey of the Oswego River System. Supplement of the 17th Annual Report of the New York Conservation Department, 1927. Albany, New York.

In order to determine facts in the much disputed problem of how to plant lake trout fingerlings, two series of experiments were performed. The first experiment showed conclusively that young trout thrive at depths of from 100 to 200 feet and find food successfully. We believe, therefore, that plantings of fingerling trout should be made in water exceeding at least 60 feet in depth because the oxygen content is adequate and the temperature is much more adapted to the young fish. The fingerlings should also be well scattered during the planting so that each will have a better chance of finding a bountiful food supply and predacious fishes will be less likely to devour a large percentage of them. We advise the planting of lake trout in all of the Finger lakes with the exception of Otisco Lake.

ECKERSLEY, M. and R. MacINTOSH. 1976. Grandview Lake 1976 lake trout netting program. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 13 p. + appendices.

Grandview Lake has been extensively stocked since 1939 with lake trout, speckled trout, rainbow trout, smallmouth bass and largemouth bass. Lake trout constitute the most recent plantings although they were first placed in the lake in 1942 and were planted sporadically until 1960. Lake trout stocking continued with recent plantings in 1973, 1974 and 1975 with a total of 25,500 fish (14,500 yearlings) being released.

The lake trout population in Grandview Lake appears to be marginal and consists of both natural and stocked fish. One of the lake trout netted was a young naturally produced fish indicating that some successful reproduction is occurring. While stocked fish do comprise a large proportion of the population as evidenced by the catch results, the total number caught was very low considering the extensive stocking program which has been carried out. Thus stocking appears lto have failed to increase the overall population level to any extent.

There are several factors which could be hindering the lake trout population in Grandview Lake. There is a relatively small area available to lake trout for summer habitat as dictated by the limitations of temperature and dissolved oxygen. The other fish species present in the lake (smallmouth bass, burbot, yellow perch, lake herring, white suckers, brown bullheads) could also be a factor limiting the size of the lake trout population. The small area of the lake and the resulting overlap of various fish species may promote predation on the lake trout.

Apparently, Grandview Lake cannot sustain a lake trout population which would support a fishery. Extensive stocking has failed to alter this situation and stocking should be discontinued.

ESCHMEYER, P. H. 1959. Survival and retention of tags, and growth of tagged lake trout in a rearing pond. Progressive Fish Culturist 21 : 17-21.

In October 1955, an experiment was begun at the Pendills Creek (Michigan) fish culture station to assist in the evaluation of returns from lake trout tagged with different types of tags. Lots of 100 each of 2-summer-old lake trout (average length of 8.5 inches) which were marked with different types of tags on October 5-11, 1955, were held in a rearing pond for one year. A control group of 100 fish were marked by removal of the adipose fin.

By May 1956, all tags had been lost from fish marked with upper jaw tags. The lake trout used in this experiment obviously were too small to retain No. 3 strap tags attached at this site. Results with streamer tags were also poor; though 19% remained in place at the end of 7 months, only 1 of 200 streamer tags remained intact at the end of one year. The following percentages of fish identified by the other types of marks were recovered at the end of the experiment: Petersen 86; cheek, 85; lower jaw, 91; and fin clip 95. The difference in rate of survival or retention of the mark among these four lots of marked fish was not significant.

These data suggest that the tags have an effect on the fish which might require consideration in the evaluation of the individual performance of brood lake trout marked with these kinds of tags and held at fish culture stations.

EUROPEAN INLAND FISHERIES ADVISORY COMMISSION (EIFAC). 1982. Report of the symposium on stock enhancement in the management of freshwater fisheries. Budapest, Hungary. 42 : 43 p.

This report summarizes the first of a series of two symposia to be held by the European Inland Fisheries Advisory Commission (EIFAC) on the topic of management of inland waters. Fish species introduced in Europe have been transplanted for a variety of purposes , most prominently to create or enhance fisheries.

Lake trout (*Salvelinus namaycush*) were introduced in Finland and Sweden to enhance fisheries in lakes influenced by hydroelectric development and fill a vacant niche in large, deep oligotrophic lakes; best success however was achieved with lake trout introductions in small, deep clearwater lakes or large lakes with populations of dwarfed whitefish, stickleback, introduced *Mysis* and smelt. No adverse impacts on native fishes were reported.

EVANS, D. O. 1992. Angling yields of wild and hatchery-supplemented stocks of lake trout, *Salvelinus namaycush*, in eastern Ontario. Ontario Ministry of Natural Resources. Maple, Ontario. 36 p. + appendices.

Annual angling harvests of lake trout (*Salvelinus namaycush*) were estimated by creel survey for 100 lakes in Ontario, Canada. My objective was to compare harvests for wild and hatchery-supplemented stocks, to test whether supplemental stocking enhances lake trout yields. Mean annual fishing effort, at a common lake area of 528 ha, was 2.2-3.7 times higher for occasionally and intensively stocked populations, respectively. Mean area-adjusted harvests were higher for hatchery-supplemented stocks, although not statistically so. Harvest-per-unit-effort in numbers (HUEN) and weight (HUEW) were significantly higher for the wild stocks. With reference to five wild stocks near maximum sustainable yield (MSY) most of the hatchery-supplemented populations were exploited at lower rates. Intensive stocking effectively raised abundance to compensate for the lost wild production caused by recruitment overfishing. Higher fishing pressure for the hatchery supplemented stocks also produced slightly higher harvests. Supplemental stocking, however, masks overexploitation of wild lake trout and can lead to the loss of wild stocks.

EVANS, D. O., J. M. CASSELMAN and C. C. WILLOX. 1991. Effects of exploitation, loss of nursery habitat and stocking on the dynamics and productivity of lake trout populations in Ontario lakes. Lake Trout Synthesis. Ontario Ministry of Natural Resources. Toronto, Ontario. 193 p.

We employed creel survey information, lake survey information, fisheries assessment data, and population modeling to evaluate the effects of angling exploitation, loss of deepwater nursery habitat, and stocking of hatchery-reared, non native stocks of lake trout (*Salvelinus namaycush*) on the dynamics of lake trout populations in Ontario lakes. Variation in lake trout harvests between lakes is primarily caused by differences in fishing effort and lake size, but season, lake productivity, and habitat quantity and quality also have significant effects. Yields of lake trout in many Ontario lakes appear to be well in excess of the natural production capacity to sustain them, especially for winter fisheries on small lakes. In these cases, yields are often maintained by stocking of hatchery-reared fish, although harvest-per-unit effort (HUE) is generally lower for populations supplemented by stocking than for self sustaining wild populations. Fishing intensity and yield are highest on small lakes, but they also receive the highest stocking rates. Stocked lakes generally had less and lower quality habitat for lake trout than lakes supporting strong self-sustaining stocks, suggesting greater sensitivity of the former to overexploitation and other stressors.

Stocking tends to stimulate fishing which, in turn, can result in displacement of the local native stock by the hatchery stock. Modeling revealed that stocking of non native lake trout, on wild populations subject to high exploitation rates, caused transformation of the genetic composition of the extant population, even when the stocked fish did not reproduce or interbreed with the native fish. Our model predicted that, at high exploitation and stocking rates presently seen in many Ontario lakes, the wild stocks would be replaced by the hatchery stock within a few generations. Widespread stocking of a few domesticated non-native stocks, therefore, appears to pose a serious risk to the genetic diversity of the species. We recommend a moratorium on widespread supplemental stocking of self-sustaining stocks. We also recommend that greater emphasis be placed on management for self-sustaining status of the lake trout resource. The best way to achieve this objective is through regulation of exploitation to allow adequate spawning escapement combined with habitat conservation and rehabilitation.

EVANS, D. O., J. BRISBANE, J. M. CASSELMAN, K. E. COLEMAN, C. A. LEWIS, P. G. SLY, D. L. WALES and C. C. WILLOX. 1991. Anthropogenic stressors and diagnoses of their effects on lake trout populations in Ontario lakes. Lake Trout Synthesis. Ontario Ministry of Natural Resources. Toronto, Ontario. 115 p.

Supplemental stocking is identified as a stressor on Ontario's lake trout stocks. Results from the lake trout questionnaire indicate that there are 269 lakes in Ontario that contain native, reproducing lake trout which also receive supplemental stocking of non-native lake trout. This represents 14.7% of the 1827 lakes in the atlas which contain native lake trout. There are considerable differences between regions in the occurrence of this stocking practice. For example, in the eastern region, 35 of the 61 native lake trout lakes (57.3%) are in this category. In the northwestern region this is the case for only two of the 515 lakes (0.4%). These geographic differences are related to the distances of the lakes from centers of high human population density.

EVANS, D. O. and C. H. OLVER. 1995. Introduction of lake trout (*Salvelinus namaycush*) to inland lakes of Ontario, Canada: Factors contributing to successful colonization. Journal of Great Lakes Research 21(Supplement 1) : 30-53.

We evaluated the success of 183 introductions of lake trout (*Salvelinus namaycush*) in small inland lakes in Ontario, Canada. Our purpose was to identify variables associated with successful versus failed natural recruitment after introductions of hatchery-reared lake trout. Origin of donor stocks, angling regulations, geophysical and water quality characteristics, and fish species presence-absence of the recipient lakes were evaluated as possible factors contributing to colonization success. Origin of donor stock had some minor influence on the success of introduced lake trout in these lakes, but other factors, including angling, were also important. Closure of lakes to fishing was strongly associated with some successful introductions. MANOVA revealed differences in the geophysical and water quality variables, and fish community structures among the native, successful, and failed lakes. The lake groups were further distinguished by canonical variate analysis using either geophysical and water quality variables and/or presence-absence of fish species. Lakes were correctly classified to one of the three lake groups with 63-83% accuracy using a cross validated, chance corrected, discriminant analysis. Lakes in which new lake trout populations failed to become established were smaller and shallower, had higher total dissolved solids, larger littoral zones, smaller hypolimnions, and richer fish communities, including more lake trout egg and juvenile predators, than lakes that were successfully colonized. Intensity of predation by indigenous species was a possible cause of failure of introduced lake trout to establish self-sustaining populations. Similar fish communities in native and failed lakes suggested that invasion and colonization by lake trout was possibly determined by the order of arrival of colonizing species. This suggested that the present day Great Lakes fish communities, which have experienced a recent net gain in species, might be resistant to reestablishment of self-sustaining lake trout stocks.

EVANS, D. O. and C. C. WILLOX. 1991. Loss of exploited indigenous populations of lake trout (*Salvelinus namaycush*) by stocking of non-native stocks. Canadian Journal of Fisheries and Aquatic Sciences 48(1) : 134-147.

A deterministic age-structured population model was developed to explore the combined effects of exploitation and stocking of hatchery reared lake trout on native lake trout populations. Stocking on non-native lake trout at moderate to high exploitation rates caused loss of the recipient population, even when the stocked fish did not reproduce or interbreed with the native fish. If hatchery fish reproduce, their progeny mask the loss of the wild stock. At exploitation and stocking rates typical of lake trout populations in Ontario, the wild stock was replaced by the hatchery stock in a few generations. Native stocks having weak recruitment are least resistant to displacement by hatchery stocks and are also the most likely to be subjected to stocking. Evidence from several field studies in Ontario generally provided support for our stock displacement hypothesis and modeling results. Extensive stocking of a few domesticated hatchery stocks has the potential to reduce genetic heterogeneity through loss of locally adapted stocks of lake trout. We suggest that emphasis should be placed on protecting the genetic integrity of the remaining self-sustaining wild stocks and that a moratorium be considered on supplementation stocking of these populations especially with non-native hatchery stocks.

FERGUSON, D. 1978. Report on lake trout spawning in the Barrie Marina. Ontario Manuscript Report. Ministry of Natural Resources. Midhurst, Ontario.

A netting project was carried out during October in Lake Simcoe to obtain information on a lake trout population spawning in the Barrie area. A total of 147 lake trout were caught and examined. All but 3 fish had left ventral fin clips and were from a Manitoba stock of lake trout stocked in 1974 and 1975.

FLOWERS, D. D. 1984. 1984 lake trout spawning shoal assessment on Lake Muskoka. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 14 p. + appendices.

In 1983, an attempt was made to locate possible lake trout spawning shoals in Lake Muskoka. Twenty-three locations were examined and lake trout were observed on four of these shoals. In 1984, similar assessment work began on October 11 and concluded on November 14. Lake trout were netted on four different nights on one shoal between October 27 and November 8.

Netting results and nightly observations of fish on this shoal showed a complete absence of small lake trout (less than eight years of age) and clipped female fish. All but one of twenty-four lake trout sampled were fin clipped males ranging in age from nine to fourteen years. A single large female (7.4 kg) was captured on November 3 but was not clipped and had no regenerated fins. Overall, it would appear that natural reproduction contributes very little to the fishery as over 95% of lake trout sampled were clipped. Future management of lake trout in Lake Muskoka should be aimed at establishing a naturally reproducing population.

FRY, F. E. J. 1939. A comparative study of lake trout fisheries in Algonquin Park, Ontario. Publication No. 58 of the Ontario Fisheries Research Laboratory. University of Toronto Press. Toronto, Ontario. 69 p.

It is evident that natural reproduction cannot keep pace with the demands that angling makes upon the lake trout population in many Algonquin Park lakes if they are open to angling every year. In many instances closure in alternate years may allow an increase in spawning but in the case of a number of lakes such closure is not feasible since cottages and fishing camps are located on their shores. In these cases it is believed that spawning must be supplemented by the introduction of fish raised by artificial propagation. We are by no means certain what numbers of young lake trout should be planted or at what size it is most economical to introduce them; these things we must still discover by experiment. However, in spite of this gap in the information we possess at present, it is still possible to draw some conclusions regarding the benefits to be derived from planting.

Lakes in which the availability of lake trout lies upon the boundary curve will not produce a further abundance of lake trout in spite of any restocking for in those waters natural reproduction is more than adequate.

Restocking, unless fish larger than the average size of those previously captured are introduced, is not likely to increase the average size of the fish taken. Under conditions where restocking is advisable, fishing intensity is likely to be so high that the average anglers will not be able to catch his legal limit in a day of fishing effort. Accordingly, although the availability of lake trout would be expected to increase under a program of restocking, the population would be likely removed as quickly as was the sparser population before, each fisherman taking his limit instead of a fraction of it. Time is necessary to produce large fish and they can only be present in numbers in lakes where the fishing intensity is low.

The maximum availability for a population of lake trout from which the fish captured were of a given average length would be the same under artificial propagation as it would be for the best natural reproduction. Thus, Source Lake under the present conditions of fishing intensity could be expected to contain a population of lake trout with a maximum average annual availability of 380 trout per 100 boat hours; Opeongo a maximum of 200 trout per 100 boat hours.

When egg counts are made on an adequate sample of individuals taken from a given lake, it is possible to calculate the total egg loss resulting from a year's fishing. In Opeongo in 1937, for example, the egg loss amounted to 2,250,000 eggs. Such statistics may form the basis of a stocking policy.

It would be desirable to continue the experimental transfer of adult lake trout from inaccessible lakes to heavily fished ones.

FULLER, P. L., L. G. NICO and J. D. WILLIAMS. 1999. Nonindigenous fishes introduced into inland waters of the United States. Special Publication No. 27. American Fisheries Society. Bethesda, Maryland. 613 p.

Lake trout have been intentionally stocked as a sport fish. It has been widely distributed from northern Canada and Alaska into various U.S. jurisdictions. Although it is found in some surrounding states, the lake trout has not been stocked in Oklahoma. Lake trout often lead to the demise of other trout species, such as bull trout, cutthroat trout and Sunappe trout, where it is introduced.

GERLACH, A. H. 1962. Klamath District. Annual Report of the Oregon Game Commission Fisheries Division. Portland, Oregon. 1961 : 222-243.

Three trap nets were set in the east end of Odell Lake on October 13 to obtain spawning lake trout. At the end of 32 fishing days, during which water temperature dropped from 52° F to 49° F, 45 lake trout had been trapped. They were transported to the Klamath hatchery and placed in holding ponds with water at 46° F in the hope that this would speed up the ripening of the females and also prevent the fish from going blind or being otherwise injured or killed in live-by. The condition of the trout remained excellent, but the majority of the females did not mature. Six of twenty females trapped were stripped and 12,000 eggs were obtained. Whether the unspawned females were green or immature was not determined since all of the trout were returned to Odell Lake. The trout ranged in length from 14.7 inches to 28.7 inches.

The number of native lake trout appearing in the egg-take continued to increase in 1962 with 39.5% present as compared to 16.4% in 1961.

Trapping of lake trout in Odell Lake should be discontinued inasmuch as the number of eggs taken does not justify the effort nor the cost of the operation. It is suggested that in the future, lake trout eggs needed for the stocking program be purchased or obtained by exchange.

GERLACH, A. H. 1963. Report on the Odell Lake fishery, Klamath District. *In* Annual Report of the Oregon Game Commission Fisheries Division. Portland, Oregon. 1962 : 220-239.

Hatchery-reared trout continue to support the lake trout sports fishery with over 50% of the 1963 catch originating from fish reared at the Klamath hatchery. Over the past twelve years (1952-1963) the proportion of stocked lake trout in the catch has ranged from 4% (1952) to 74% (1955).

The 1951 release (adipose fin removed) was the predominant mark examined in 1963. In 1962 there was some doubt whether all of the adipose marked fish were from the original release or partially from the 1959 stocking. Scale reading confirmed that all adipose marked lake trout were from the release made in 1951. The lake trout planted in 1951 ranged from 16 to 27 inches in length in 1961.

Regeneration of fins has not occurred in a group of lake trout held at the Klamath hatchery for the past five years.

GERLACH, A. F. 1967. Lake trout investigations at Odell Lake, Oregon 1951-1961 with special emphasis on results of the hatchery program. Central Region Administrative Report 67-6. Oregon Game Commission. Portland, Oregon. 24 p.

Lake trout were first introduced into Odell Lake sometime between 1902 and 1917. The first release of yearling hatchery lake trout (1951) was successful, furnishing 44% of the checked lake trout in the sport catch, while those after furnished only 5%. In revising the total hatchery program, it is concluded that it was not a success since only 0.1% of the total fish released were later observed in sport catch.

The mean length of the sport-caught lake trout dropped from a high of 29 inches in 1952 to a low of 18.5 inches in 1961. A condition factor "K" was calculated for the lake trout and found to be 1.27. Compared with fish from other regions, lake trout from Odell Lake are less robust. A condition factor for native trout and trout from the 1951 release was approximately the same. The length-weight formula $\text{Log}(W) = -4.37604 + 2.809281 * \text{Log}(L)$ was calculated.

Seventy-three percent of the sport-caught lake trout were from six to nine years old. Wild trout over seven years are longer at a given age than trout from the 1951 release.

Whitefish is the principal forage fish occurring in the diets of the lake trout. Salmonids were found in 5.3% of the stomachs.
The only factor that can be found to date for the failure of the hatchery releases from 1952-1961 is that of race adaptability. Very little was learned about the spawning habits of lake trout in their natural habitat since the fish could not be found during the spawning activity. A sudden drop in water temperature did not hasten the ripening process of green females transported to covered hatchery ponds. The mean length of gravid female lake trout was 28.6 inches and the mean number of eggs per fish was 4,358.

GERRIE, B. E. 1986. Test netting on Smith Lake 1986-87. File Report. Ontario Ministry of Natural Resources. Kapuskasing, Ontario. 3 p.

Smith Lake, Howells Township, has been stocked with lake trout in 1971 (2,000 yearlings), 1976 (2,500 yearlings), 1978 (2,000 yearlings) and 1981 (2,000 yearlings) and with 1,500 splake in 1984. On September 24, 1986 test netting was conducted to determine post-stocking survival and to evaluate natural lake trout reproduction. Two gill nets were set for short periods (1-1 1/2 hours). Only one lake trout and one splake were captured. There was no evidence of successful natural reproduction although an angler stated that he had caught a small lake trout.

It is recommended that this lake be maintained as a put-and-take fishery for lake trout or splake. The lake should also be considered to determine the feasibility of spawning bed construction. Finally, if a new forest access road is maintained efforts should be made to restrict it to ATV or snowmobile traffic only.

GIBSON, B. H. 1968. The Lake Nipigon commercial fishery. Ontario Fish and Wildlife Review 7 : 11-16.

A three year lake trout study, completed in 1962, involved the sampling of trout caught by commercial fishermen to determine growth rates, food habits and fishing pressure. This study indicated the futility of stocking hatchery-reared lake trout in Lake Nipigon to help maintain the commercial fishery. Between 1951 and 1956, a total of 173,000 fingerling and yearling trout were stocked. In the three year study, in which 1,536 lake trout were examined, only 16 (approximately 1%) of the fin clipped stocked fish were recovered by commercial fishermen. It appears that conditions for natural reproduction and survival of lake trout are entirely adequate to maintain the populations. Continued stocking of lake trout is not considered necessary and has been discontinued.

GILLAP, D. 1983. A summary of a voluntary summer creel census on Silent Lake. Fisheries Management Report 1983-06. Ontario Ministry of Natural Resources. Bancroft, Ontario.

From June 21 to September 7, 1982 the staff of Silent Lake Provincial park continued implementation of a voluntary creel census of Silent Lake. A total of 15 lake trout were reported caught. Forty-four percent of the lake trout caught were of hatchery origin.

GOEDE, R. W. 1986. Management considerations in stocking of diseased or carrier fish. p. 349-355. *In* R. H. Stroud [ed.]. Fish Culture in Fisheries Management. Fish Culture and Fisheries Management Sections, American Fisheries Society. Bethesda, Maryland.

The specialized and increasingly proficient fish cultural operations are periodically besieged by a variety of disease problems. These problems are often infectious in nature and are capable of inducing losses that range from minor annoyances to catastrophic devastation which essentially eliminates entire stocks of fish. Often, the population is showing no losses but contains many individuals which have latent infections with serious pathogens, that is carrier fish. Some of the problems associated with stocking diseased fish include direct mortality, establishing a reservoir of infection, increased sensitivity to stressors and reduced performance.

The basic framework of sound biological information and methods exists at this point in time to provide some rationale relative to decisions concerning disposition of diseased hatchery stocks. It should now be possible to assign levels of concern with respect to receiving waters and pathogens to present proper recommendations to administration. Trained fish health specialists should be in place in active and advisory capacities to aid in initiation of quality control programs. Quality of fish reared and planted should be quantifiable and incorporated in the body of records. Similar health or quality assessment should be incorporated in field programs evaluating success of free-ranging stocks.

GÖNCZI, A. P. and N. A. NILSSON. 1983. Results of the introduction of lake trout (*Salvelinus namaycush*) into Swedish lakes. p. 68-75. *In* Stocking of Fish and Crustaceans: 12th Symposium of EIFAC, Budapest, Hungary.

Lake trout has been introduced into Swedish lakes since 1959. The outcome has been very variable, the percentage of recapture ranging between 0-60%. The growth rates of the introduced fish also varies considerably, depending on the availability of suitable prey, which mainly consists of dwarfed whitefish, cisco, smelt and *Mysis relicta*. No harm to the native fish populations has been observed. On the other hand many valuable introductions have been recorded.

GRAY, J. E. and D. MARALDO. 1981. A historical look at the fisheries of Saddle, Sill, Goulais, Gong, Megisan, Astonish, Flack and Elliot lakes. File Report. Algoma Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Sault Ste. Marie, Ontario. 99 p.

With the establishment of the Algoma Fisheries Assessment Unit in 1980, it became necessary to compile existing fisheries data for the eight lakes in the unit. The resulting report provides a "background document" which summarizes in general terms the previous status of the fish communities in the lakes and identifies potential major stresses that have occurred.

Flack Lake was stocked for three consecutive years in the mid 1960s (5,000 in 1964, 3,000 in 1965 and 7,000 in 1966) with lake trout. Lake trout originating from Elliot Lake were stocked in 1964 and 1965 while fish originating from Chiblow Lake were stocked in 1966 to determine if one strain had better survival that the other. Stocking was initiated at this time because it was felt that the lake was being overfished.

Elliot Lake was stocked on an irregular basis between 1958 and 1974 with at least 5 different strains of lake trout (Sault domestic, Lake Superior, Lake Manitou, Ranger Lake, and Lake Simcoe).

There was only one documented report of lake trout stocking in Megasin Lake. This involved the release of 10,000 Lake Superior strain fish in 1938. Plantings of brook trout were also made in 1949 and 1950. It is not known whether these stockings were successful or if they were requested by the lodge owner.

Both brook trout and lake trout were stocked in Gong Lake between 1949 and 1968. Lake trout plantings involved the release of 6,000 fish (Lake Superior strain) in 1954, 4,000 fish (Lake Superior strain) in 1965 and 9,000 Lake Manitou strain trout in 1968.

GREENE, C. W. 1955. Lake trout. The New York State Conservationist 9(5) : 26-28.

Several lake trout research projects are presently underway in New York. One of these projects is designed to determine the extent to which lake trout stocking is contributing to the fishery and compare results from stocking fingerling and yearling lake trout. This project is being conducted on eight lakes, in addition to Cayuga from 1950 through 1953, involves fin clipping nearly 600,000 young trout. To date most recaptures (43 fish) have occurred in Seneca Lake. Comparative recoveries of fingerling and yearling stocks were in a ratio of 1:6.6. The slow rate of returns to date is not unexpected since lake trout grow slowly and the small fish are notoriously difficult to catch by any method.

GRIEST, J. R. 1977. The lake trout of Twin Lakes, Colorado. Engineering and Research Center, Bureau of Reclamation. Denver, Colorado. 29 p.

Growth, survival, reproduction, recruitment and food habits of lake trout in Twin Lakes, Colorado, were examined during 1974-75 to document the status of the trout population prior to completion of a 200-megawatt pumped-storage hydroelectric power plant being constructed on the lake. The powerplant will become operational during 1977, and data collected during this study will be compared to similar data collected during the post-construction period to determine the effect of plant operation on the trout population. Growth of lake trout in Twin Lakes is comparable to that of other lake trout fisheries in the Western United States, such as Lake Tahoe, Nevada-California, and Fish Lake, Utah, and is somewhat faster than most lakes located in Canada. Annual mortality was found to be near 50%, which compares with other trout fisheries of this type. Successful reproduction of lake trout was confirmed by the presence of age classes that had not been stocked. Approximately 90% of the 4-year old fish captured during this study were from natural reproduction. Lake trout reaching the legal size limit of 381 mm were usually 4-year-olds, with approximately 20% of the population reaching this size each year. Lake trout in Twin Lakes feed primarily on *Mysis relicta*. Chironomid larvae, white suckers, and rainbow trout are also eaten. Possible effects of powerplant operation on the lake trout population are outlined and discussed.

GRIMM, M. P. 1983. Toward the formulation of guidelines for stocking of fish in Europe. European Inland Fisheries Advisory Commission. Hamburg, Germany.

The stocking of fingerlings of predator species to increase population densities appears to be either totally unsuccessful or serious doubt about the good results reported seems to be justified. The faith or trust in the beneficial results of stocking might be responsible for the lack of basic evaluation studies on the introductions of many species.

For the purpose of setting up provisional guidelines, issues which must be addressed include habitat requirements, possibilities of natural reproduction, minimum abiotic conditions required to establish the species and possible niche overlap with autochthonous species.

GS ENVIRONMENTAL SERVICE. 2000. 2000 spring littoral index netting (SLIN) program on Lake of Bays. Report prepared for the Ontario Ministry of Natural Resources. Bracebridge, Ontario. 4 p. + appendices.

Lake of Bays is a large (7,056 ha), relatively deep coldwater lake. Lake trout (*Salvelinus namaycush*) were part of the original fish community of this waterbody. Despite the presence of native fish, Lake of Bays was regularly stocked with lake trout from 1916 until 1993. Since 1994 no lake trout have been stocked in the lake in an effort to determine whether the population could maintain itself through natural reproduction.

In 2000, a spring littoral index netting (SLIN) program was conducted to establish the relative abundance of stocked to naturally reproduced fish. A total of 72 net sets of 90 minutes each were completed over a 22 day period extending from April 25 to May 16, 2000. Lake trout appeared to be abundant with a catch-per-unit-of-effort (CUE) of 1.111. Sixty of the eighty lake trout examined appeared to have resulted from natural reproduction as there was no evidence of previous fin clips. Of those fish with fin clips the majority were adipose fin clips.

Recruitment seems to be good since there are significant numbers of small fish in the population. There were many fish in the catch distribution that were smaller than the last cohort of stocked lake trout in the population (yearlings with adipose clips stocked in 1993). Stocked fish now make up a relatively small percentage (15%) of the population. The lake trout population is self-sustaining and stocking should not be resumed in order to protect the gene pool of natural stock.

GUNN, J. M. 1980. Notes on stocked and native lake trout in acidic Laundrie Lake, 1976-1979. Manuscript Report. Ontario Ministry of Natural Resources. Sudbury, Ontario. 34 p.

Recruitment failures have occurred in the lake trout population of acidic (pH 4.7-5.2) Laundrie Lake. Netting surveys during 1976-1979 revealed that only a few large (>53.0 cm) native trout remain. These fish are sexually mature at spawning time. Egg size and number are within normal ranges and egg deposition appears to occur. Recruitment failures appear to be caused by acidification.

Laundrie was stocked with 8,000 fingerling lake trout in September 1977. The introduction was successful and the stocked fish grew well reaching 26 cm (FL) in two years. Stomach analysis have shown that both native and stocked lake trout feed primarily on benthic and planktonic invertebrates.

GUNN, J. M. and W. KELLER. 1981. Emergence and survival of lake trout (*Salvelinus namaycush*) and brook trout (*S. fontinalis*) from artificial substrates in an acid lake. Ontario Fisheries Technical Report Series No. 1. Ontario Ministry of Natural Resources. Toronto, Ontario. 9 p.

Eyed eggs of lake trout (*Salvelinus namaycush*) and brook trout (*S. fontinalis*) were incubated overwinter in crushed limestone and mixed noncalcareous gravel substrates in the acidic waters (pH ~ 5.2) of George Lake. Alevin emergence for both species (33.6-73.0%) was generally good from limestone substrates (interstitial water pH > 6) and almost nonexistent (0.1-1.3%) from mixed gravel substrates (interstitial water pH ~ 5.5).

Survival of alevins of both species hatched in limestone was high during 7 day holding periods in both the acidic lake and at a control sit in the near-neutral waters of Killarney Bay (89.5-100%). High alevin mortality observed after 30 days of an extended (41 day) exposure in George Lake appeared related to feeding and containment problems rather than pH toxicity.

The substantial alevin emergence from limestone and the high survival during 7 day and 30 day holding periods indicate that small scale limestone applications to provide spawning substrates would enhance salmonid recruitment in some acidic lakes.

GUNN, J. M. and W. KELLER. 1984. Spawning site water chemistry and lake trout (*Salvelinus namaycush*) sac-fry survival during spring snowmelt. Canadian Journal of Fisheries and Aquatic Sciences 41 : 319-329.

During the spring of 1982, lake trout (*Salvelinus namaycush*) sac fry were incubated at a spawning bed in a pH 5.7 lake with a history of lake trout recruitment failure. Four short episodes of substantial pH depression occurred at the spawning site. Observed sac fry mortalities (18%) occurred primarily during the longest depression (5 days at pH 4.5-5.0), which coincided with maximum surface runoff and peaks in concentrations (~ 50 µg/l) of inorganic (monomeric) aluminum. Although most mortalities coincided with low pH and elevated inorganic aluminum concentrations, the high survival (82%) demonstrated that under natural conditions most sac fry could tolerate a pH < 5.0 and inorganic aluminum concentrations of 40-50 µg/L for at least 5 days. Substantially higher concentrations of inorganic aluminum (~80 µg/L) were observed in the interstitial waters of the spawning rubble than in the ambient waters, which indicated that fry within a spawning substrate may be subjected to more toxic conditions than test fry in incubators above the substrate surface.

GUNN, J. M. and K. H. MILLS. 1998. The potential for restoration of acid-damaged lake trout lakes. Restoration Ecology 6(4) : 390-397.

This review of long term monitoring and experimental manipulation studies from Ontario, Canada, offers encouraging evidence that lake trout (*Salvelinus namaycush*) populations can be restored to acidified lakes once the problem of acid deposition is solved in North America. Some options for managing recovering lakes are also reviewed including increased pollution controls, liming, hatchery stocking, and harvest controls.

When water quality does improve in acidic lake trout lakes, management efforts are needed to re-establish species that have limited ability to recolonize on their own. For lake trout, stocking of hatchery-reared fish is a well established technique for re-introducing populations. Some success with hatchery stocking has already been achieved in formerly acidic lakes in the Sudbury area and several other lakes are currently being restocked. Recovering lakes appear to be ideal for hatchery stocking because they often have abundant yellow perch, a favourite prey species of lake trout, but may lack many of the competing fish species. The lakes that prove to be difficult to restock are those with abundant cisco, an acid tolerant species that competes heavily with introduced juvenile lake trout.

GUNN, J. M., M. J. McMURTRY, J. N. BOWLBY, J. M. CASSELMAN and V. A. LIIMATAINEN. 1987. Survival and growth of stocked lake trout in relation to body size, stocking, season, lake acidity and biomass of competitors. Transactions of the American Fisheries Society 116(4) : 618-627.

Juvenile hatchery-reared lake trout (*Salvelinus namaycush*), 25-36 months old, were stocked (about 24 fish/hectare) in six small oligotrophic lakes to test the effects of fish size, stocking season and lake water acidity on survival and growth of introduced fish. The test lakes had few, if any, native lake trout. Little or no survival of stocked lake trout occurred in lakes with pH 5.0 or less. High survival and growth occurred in intermediately acidic (pH 5.6-6.1) and circumneutral (pH 6.9-7.3) lakes. Survival of stocked lake trout increased with size at the time of stocking. Size differences of the three size classes introduced in each lake were maintained throughout the two-year study. Competition with other resident fish species appeared to influence stocking success strongly. There was an inverse relationship between the biomass of stocked lake trout subsequently recaptured and biomass of all hypolimnetic species present in the lake. Intraspecific competition with previously stocked lake trout also appeared to restrict survival of lake trout in subsequent stockings.

HACKER, V. A. 1957. Biology and management of lake trout in Green Lake, Wisconsin. Transactions of the American Fisheries Society 86 : 71-83.

Information on spawning, feeding habits and on growth and condition of planted lake trout in Green Lake, Wisconsin, is presented. Failure of natural reproduction of the planted trout of Great Lakes stock in this lake is attributed to lack of cover for the eggs on the spawning bar and subsequent predation by *Necturus*. An artificial spawning bed of angular fragments of rock deposited on the spawning bar in 60 to 100 feet of water appears to be providing the necessary egg protection. In this oligotrophic lake of 7,325 acres *Mysis* is the main food of immature trout shorter than 14 inches and ciscoes the principal food of adult trout longer than 27 inches. Length-weight relationship is of the usual pattern and coefficient of condition for the younger fish about the same as reported for the Great Lakes trout but is higher for the larger adult fish. Average egg production of 18 females, at least 12 years old, was 5,417 eggs in the fall of 1956. It is suggested that selection of an unfavorable deep-water spawning area in preference to more suitable areas in shallower water is inherent in the race of trout stocked here.

HACKER, V. A. 1958. Lake trout netting, tagging and spawning observations at Green Lake, Green Lake County – October and November 1958. Memorandum No. 2 Fisheries Management Division. Wisconsin Conservation Department. Madison, Wisconsin. 14 p.

Seasonal lake trout spawning operations on Green Lake were conducted between October 31, 1958 and November 28, 1958. During the 1958 operation, a total of 191 fin clipped trout were taken in the nets. It was anticipated that during the 1958 netting season, good numbers of ripe females originating from the 1953 plantings (83 months old) would be found on the spawning grounds. In actuality, only one 25.3 inch ripe female was taken containing 3 ounces of eggs at 285 eggs per ounce for a total of 855 eggs.

HACKER, V. A. 1962. A summarization of life history information of the lake trout (*Salvelinus namaycush*) obtained in gill netting, fin-clipping and tagging studies at Green Lake, Wisconsin – 1956-1961. Investigation Memorandum No. 3. Fisheries Management Division, Wisconsin Department of Natural Resources. Madison, Wisconsin. 24 p.

Lake trout (*Salvelinus namaycush*) were first stocked in Green Lake, Wisconsin, in 1886 with plantings of this species continuing uninterrupted until 1944. During that year, test gill nets disclosed a good population of lake trout but fishermen experienced little angling success. The test nets dictated no necessity for continued stocking in view of poor angling returns and plants of this species were stopped. In 1953 and in each following year to the present, fingerling lake trout, marked with identifying fin clips or maxillary bone clips have been stocked in Green Lake.

Nets set prior to the first (1953) plant of marked lake trout showed no small trout under 25.5 inches to be present. Almost immediately after marked lake trout were stocked, small lake trout were taken by nets and by angling at various locations in Green Lake. It was therefore concluded that, because small lake trout were not found prior to stocking and only fin clipped trout were caught after stocking, naturally reproduced lake trout were not present at that time. At present Green Lake contains one group of 19 + year old lake trout stocked either in 1944 or some prior year and another group of marked fish stocked since 1953, ten years old or younger. A gap of nine years exists between the two groups caused by the lack of stocking between 1944 and 1953. This report summarizes findings of studies up to and including 1961 operations.

Lake trout stocked in Green Lake during 1953 and 1954 reached legal size very rapidly. The unusually large numbers of the opossum shrimp (*Mysis relicta*) were, undoubtedly, responsible for the rapid growth. The only other groups of lake trout stocked in Green Lake since 1953, which have grown to legal size, are the 1955 plant where 45.4% are over 17.0 inches and the 1956 plant with 11.0% of the total being legal. At present, Green Lake supports a large population of lake trout as old as six years of age with not one fish in the group reaching the legal size of 17 inches.
It is recommended to reduce by 50% the number of 4-5 inch lake trout presently stocked and concentrate on raising a larger, better quality trout. This would be a production goal of 25,000 rather than the present 50,000 now reared at the Green Lake ponds.

HALL, B. W. 1969. Winter creel census on Fern Lake Sault Ste. Marie District – 1969. Manuscript Report. Ontario Department of Lands and Forests. Sault Ste. Marie, Ontario. 7 p.

Fern Lake was surveyed in 1963. The lake has a surface area of 204 acres and a maximum depth of 80 feet. The only game fish found in the lake was brook trout and the lake survey report recommended that the lake be planted with lake trout. The initial introduction of lake trout occurred in 1964 (4,000 yearlings bearing an RPAd clip) and additional plantings were made in 1966 (4,000 yearlings bearing an LPRV clip) and 1968 (2,000 yearlings bearing an Ad clip).

During the winter months of January-March, 1969, Fern Lake anglers caught an estimated 253 lake trout weighing 149 pounds during 1,092 hours of fishing effort. The lake trout introduced to Fern Lake in 1964 produced in 1969 an estimated 3.5 pounds of fish for every pound planted. The cost:benefit ratio was 1:3.54. The 1966 plant produced approximately 0.75 pounds of fish for every pound planted. The cost:benefit ratio was 1:0.76.

Stocking should be discontinued pending assessment of natural reproduction by a creel census or lake survey in the early 1970s.

HAMILL, J. 1995. 1995 summer lake trout assessment SLIN netting (Elizabeth, Ortona and Florence lakes). File Report. Ontario Ministry of Natural Resources. Blind River, Ontario.

Ortona Lake, Lockeyer Township, was assessed between July 11 and July 14, 1995 using an abbreviated spring littoral index netting (SLIN) methodology. A total of 35 fish (18 lake trout, 15 lake whitefish, and 2 common white sucker) were captured in 27 net sets 90 minutes in duration. The catch per unit effort for lake trout was 0.67 trout per 90 minute, 3 panel set. A total of 6 lake trout died as a result of the sampling effort putting mortality at 33.3%. All of the 18 lake trout sampled were clipped. Natural recruitment can be considered to be weak if not non-existent. Stocking should be continued.

Elizabeth Lake, Foster Township, was assessed between July 4 and July 17, 1995 using an abbreviated SLIN methodology. A total of 147 fish (26 lake trout, 120 lake whitefish, and 1 smallmouth bass) were captured in 27 sets 90 minutes in duration. The catch per unit effort for lake trout was 0.96 trout per 90 minute, 3 panel set. A total of 8 lake trout died as a result of the sampling effort putting mortality at 30.8%. Of the 26 lake trout sampled, 22 were clipped and 4 were unclipped indicating a natural trout component of up to 15.4%. All of the unclipped trout were relatively large (between 1600 gm and 3000 gm). Natural recruitment can be considered to be weak. Stocking should be continued.

Florence Lake, Mongowin Township, was assessed between July 18 and July 20, 1995 using an abbreviated SLIN methodology. A total of 23 fish (5 lake trout, 6 F_1 splake, 6 lake herring, 4 smallmouth bass, and 2 rock bass) were captured in 27 sets each 90 minutes in duration. The catch per unit effort for captured lake trout was only 0.19 trout per 90 minute, 3 panel set as compared with 0.96 and 0.67 for Elizabeth and Ortona lakes respectively (also assessed July 1995). The splake catch was unanticipated. Obviously splake have made their way to Florence Lake via a small tributary from Alexander Lake which has been stocked with 1500 to 2000 yearlings annually since 1991. The catch per unit effort for splake was 0.22 bringing the total salmonid CUE up to 0.41. Although all 5 of the lake trout sampled were live released, 5 of the 6 splake died as a result of the sampling (83.3% mortality). All of the 5 lake trout sampled were clipped. They were healthy and relatively large, ranging in weight from 1200 gm to 4200 gm. Natural lake trout recruitment can be considered to be weak, if not non-existent. Stocking of lake trout may be continued; however, splake stocking may provide better returns and should be considered.

HAMILL, J. 1998. Lake trout stocking assessment (Bellows, Kecil, Clear and Little Serpent lakes) and lake herring assessment netting (Bellows and Kecil lakes). Ontario Ministry of Natural Resources. Blind River, Ontario.

Kecil Lake, Victoria Township, was surveyed from July 14-17, 1998 using a modified version of the spring littoral index netting (SLIN) methodology. Of the 152 fish which were caught, 11 were lake trout. The catch-per-unit-of-effort (CUE) for lake trout was 0.41 fish per 90 minute three panel set. Ten of the eleven lake trout were fin clipped so natural recruitment is estimated to be low in Kecil Lake. There were five different age classes in the lake trout catch. There should have been a wider range of age classes within the lake due to the number of years it has been stocked. One hundred and thirteen lake whitefish were caught which may be a concern for the future.

Bellows Lake, Deagle Township, was surveyed between July 21-23, 1998. A total of 104 fish were captured in 27 gill net sets each being 90 minutes in duration. Fifteen lake trout were captured for a CUE of 0.55 trout per 90 minute three panel net set. Only five of these fish were unclipped. Seven year classes were found with the presence of a natural population. Stocking should be continued in Bellows Lake.

Clear Lake, Shedden Township, was surveyed from July 28-30 using the same assessment techniques. Of the 142 fish caught, 13 were lake trout. The lake trout CUE was 0.54 fish per 90 minutes three panel set. Five of the thirteen trout were fin clipped. Clear Lake seems to have a viable population of lake trout with a wide size class distribution and an abundance of mature adults for reproduction. Stocking should not be continued in Clear Lake.

Little Serpent Lake, Deagle Township, was surveyed between August 4-5, 1998. Of the 160 fish caught there were 24 lake trout representing a CUE of 1.33 trout per 90 minute three panel set. All but one lake trout was fin clipped. Although Little Serpent Lake has only been stocked since 1995 the trout population appears to be doing very well. Six different age classes of trout were represented. Two of these age classes of trout may have originated from Bellows Lake which flows into Little Serpent Lake. Since natural recruitment is very low to non-existent, stocking should be continued with further assessment in the future.

HAMILTON, R. 1979. Lake trout management in the Thunder Bay District. Interim Management Plan. Ontario Ministry of Natural Resources. Thunder Bay, Ontario. 29 p.

In the Thunder Bay district there are 90 lakes identified as containing lake trout. A committee was developed to designate lake trout waters into one of three different classes and to devise a short- and long-term management program.

With respect to fish stocking, stocking practices can be a viable management tool to supplement and maintain lake trout populations. However, research into increasing the success rates of stocked species on top of naturally occurring species of lake trout is normally less than 1%. Factors of predation and direct competition for habitat and food affect stocking success. Research into the effects of stress induced by fin clipping or tagging should be monitored. Introductions into barren oligotrophic lakes as well as into rehabilitated lake trout lakes should be considered as a management option to increase the distribution of lake trout.

HARRISON, T. G. 1969. 1968 spawn taking on the Mishibishu chain of lakes. File Report. Ontario Department of Lands and Forests. White River, Ontario. 9 p. + tables.

In 1958, four thousand $2^1/2$ year old lake trout were planted in Mishibishu Lake and five thousand were released at the mouth of the Dog (University) River. Also, in 1963, 1,600, 2,000 and 1,900 $3^1/2$ year old trout were planted in Mishibishu, Mishi and Katzenback lakes, respectively. These trout originated from the Purvis commercial fishery and therefore were probably shoal spawners from Lake Superior. Lake Superior lake herring were introduced in 1966 and 1967 in an effort to increase the growth rate of the trout and also the egg production.

Three six foot trap nets caught eighty 1958 fin clipped trout, one 1963 fin clipped trout and 240 trout from natural reproduction in Mishibishu Lake. Sixteen ripe and two partly spend 1958 fin clipped females along with two ripe naturally produced females produced 37,581 eggs. None of the seven 1963 fin clipped trout examined in Mishibishu Lake had reached maturity after almost eight years of life. We suspect this condition in Mishibishu is due to the competition in existence in Mishibishu Lake when the trout were introduced. The maturity of this 1963 plant appears to be directly related to the relative numbers of 1958 fin clips present in the three lakes. In test gill netting (19 sets) 60 trout from the 1958 plant, 6 trout from the 1963 plant and 27 naturally produced lake trout were captured.

Three six foot trap nets caught fifty-nine 1958 fin clipped trout, one hundred and forty-six 1963 fin clipped trout and 88 naturally produced trout in Mishi Lake. Two ripe and one partly spent 1958 fin clipped females along with eleven 1963 fin clipped females produced 24,019 eggs.

Three six foot trap nets caught five 1958 fin clipped trout, two hundred and fifty-seven 1963 fin clipped trout and sixty-one naturally produced trout in Katzenback Lake. Four ripe 1963 fin clipped females produced 6,203 eggs.

The total egg collection for these three lakes was approximately 68,000.

HARRISON, T. G. 1970. The case of the substitute lake. Ontario Fish and Wildlife Review 9(3-4) : 3-6.

By 1955 the lake trout population of Lake Superior had dropped to two-thirds of its former level and was plainly on the skids due to predation by the newly-introduced sea lamprey. In the fall of 1955, spawn was collected from the relatively rare river-spawning strain near the mouth of the Dog River which is located fifteen miles west of Michipicoten Harbour. The eggs were hatched and reared for two and one-half years at Tarentorous Hatchery in Sault Ste. Marie. During the summer of 1958, 4,000 trout were planted in Mishibishu Lake, 5,000 were planted at the mouth of the Dog River, and the remaining portion were held at Tarentorous Hatchery. In 1961, sampling showed that the fish had grown rapidly and were maturing early. By 1962 full scale spawn-taking operations began in Mishibishu Lake and have been carried out every year since. During the fall of 1965 it became apparent that the growth rate of Mishibishu trout had been extremely slow during the previous three years. In effort to remedy this problem, cisco (lake herring) were introduced into Mishibishu since these fish are year-round food supplies for trout in other waters. About mid-March in 1966 and 1967, the eyed eggs were flow to Mishibishu Lake and planted beneath the ice in 2-10 feet of water. Both herring plants were successful.

The Mishibishu lake trout project has achieved its initial purpose of preserving some of the original Lake Superior lake trout stock. Although egg collections to date from Mishibishu Lake have not been plentiful, we anticipate considerable returns when abundant offspring from the original stock come into production.

HASKELL, D. C. 1952. Comparison of the growth of lake trout fingerlings from eggs taken in Seneca, Saranac, and Raquette lakes. Progressive Fish Culturist 14(1) : 15-18.

The propagation of the lake trout (*Cristivomer namaycush*) is an important part of the hatchery production of New York State. Eggs are obtained from wild fish by netting operations in several of the lakes (Seneca, Raquette and Saranac) of the State. This experiment was designed to compare the relative growth rates of Seneca, Raquette and Saranac Lake lake trout fingerlings under uniform hatchery conditions.

When adjustments of the growth rates for temperature differences has been made and the strains are compared at equal ages, the Seneca fingerlings have a more rapid growth rate than the fingerlings from Raquette and Saranac lakes. Growth rates of Raquette and Saranac fingerlings are nearly the same. The data suggest that careful selection of a source of eggs from wild fish is fully as important as selective breeding of those species for which the brood stock is reared in the hatchery.

HASKELL, D. C., R. G. ZILLIOX and W. M. LAWRENCE. 1952. Survival and growth of stocked lake trout yearlings from Seneca and Raquette lake breeders. Progressive Fish Culturist 14 : 71-73.

The purpose of the present study was to compare the survival and growth of lake trout yearlings of Seneca and Raquette breeders and stocked in Raquette Lake in May, 1942. All fish were marked by the removal of a ventral fin. The average length of the fish at the time of planting was 5.75 inches for the Senecas and 5.0 inches for the Raquettes.

All assessment netting was done using trapnets. With the inclusion of two Raquettes that were taken by angling in 1951, the total known survivals were 49 Raquettes and 2 Senecas.

The survival of yearling lake trout from Raquette Lake breeders appeared to be considerably better than the survival of the yearlings from Seneca Lake breeders. The inference is that there may be racial differences between the lake trout in Seneca and Raquette lakes that affect survival. Length and weight data suggest that the growth rate of lake trout of Raquette Lake origin stocked as yearlings may be slower than the growth rate of trout from natural reproduction and fingerling stocking. The removal of ventral fins is judged to provide a satisfactory means of marking yearling lake trout for long term studies.

HASSINGER, R. and D. WOODS. 1974. Evaluation of Fintrol as a fish toxicant in deep softwater lakes. Investigational Report No. 325. Division of Fish and Wildlife, Minnesota Department of Natural Resources. St. Paul, Minnesota. 13 p.

Successful rehabilitation of four, deep, softwater trout lakes totaling 24,709 acre-feet of water was accomplished with Fintrol at a concentration of 1 ppb active ingredient. The toxicant was applied during the fall turnover to assure rapid mixing, and both sand grain and liquid formulations were used to achieve effective coverage. Treatment was lethal for all target species fish but had no long-term effects on invertebrates. The total cost of treatment was $0.77 per acre-foot. Survival and growth of the planted trout was excellent and a substantial sport fishery developed within two years following stocking. Rehabilitation of large, deep softwater lakes with Fintrol at fall turnover shows considerable promise as a fisheries management technique.

HAXTON, T. 1991. Lake trout post-stocking assessment on eleven Minden District lakes. File Report. Ontario Ministry of Natural Resources. Minden, Ontario.

Post-stocking assessment was conducted on eleven Minden District lake trout lakes from May 28, 1990 through July 31, 1990. A total of 92 lake trout were sampled from these lakes, 45% of which were stocked. Management recommendations derived from this assessment are: to discontinue stocking lake trout in six of these lakes due to presence of natural population or the lack of suitable habitat; and to continue stocking the other five lakes.

HECKART, L. and E. ROGUSKI. 1966. Inventory and cataloging of the sport fish and fish waters in the interior of Alaska. *In* Sport Fish Investigations of Alaska. Alaska Department of Fish and Game, Annual Progress Report 1965-66. Report 15-A, 7 : 215-229.

Four streams and four lakes were surveyed during the reporting period, and eighteen lakes were test netted for fish population composition and analysis. Winter oxygen determinations were made on 22 lakes to learn their potential for future stocking and subsequent fisheries management.

Annual assessment of the stocked lakes was continued to determine fish population trends and the success of the existing stocking program. A second transplant of adult lake trout was made into Harding Lake from Monte Lake in the Alaska Range.

HEIDINGER, R. C. 1999. Stocking for sport fisheries enhancement. p. 375-401. *In* C. C. Kohler and W. A. Hubert [eds.]. Inland Fisheries Management in North America. American Fisheries Society. Bethesda, Maryland.

Fish are currently being raised for stocking in sport fisheries by federal and state agencies and by private fish culturists. Including private stocking, I estimate that approximately 2.5 billion sport fishes are stocked annually in the United States and Canada. In 1995-96, 70 federal hatcheries, 48 states and 8 provinces stocked 276 million coldwater sport fishes. Lake trout stocking amounted to 19,576,000 fish. The majority of lake trout (18,672,000 fish) were stocked as fingerlings, 921,000 fish were stocked at sizes greater than 203 mm, and 82,000 were stocked as eggs.

HENDERSON, B. A. 1982. The population dynamics of lake trout (*Salvelinus namaycush*) in Lake Manitou, in relation to the planting and spawn-taking operation. Ontario Fishery Technical Report Series No. 5. Ontario Ministry of Natural Resources. Toronto, Ontario. 14 p.

Lake Manitou has been used increasingly for angling and recreation, and as a source of lake trout (*Salvelinus namaycush*) eggs. An increasing number of lake trout have been introduced to compensate for this increased use of trout. The first trout introductions in Lake Manitou were made in 1952. The ratio of native to planted fish has fluctuated since 1963, but in recent years has fallen to a sustained low level, indicating poor recruitment. The purpose of this study was to determine why recruitment levels have fluctuated and fallen to a sustained low value. Lake trout caught in trap nets set on spawning shoals during the spawn-taking operation provided nearly all the information on population size, age composition, year-class strength, and mortality rates. An annual winter creel census gave an estimate of angling mortality.

Population sizes of planted trout have increased consistently, but the number of native trout has fluctuated over the years and is now low. Recruitment to age 7 from the first two plants was 26%, but subsequently fell to approximately 5%. Natural recruitment reached two peaks in 1965 and 1973, but since then has fallen to a sustained low level, corresponding to a decline in year-class strength. A simulation model of population dynamics showed that the first two peaks of natural recruitment were a function of reproduction of the planted stock. Although the decline in recruitment, in recent years, was a function of change in age composition and fecundity of the spawning population, the sustained low level of recruitment was not a function of either mortality rates or spawn-taking. Mortality at the egg or larval stage may be the main cause of variations in recruitment.

HICKLEY, P. 1993. Stocking and introduction of fish – A synthesis. p. 247-254. *In* I. G. Cowx [ed.]. Rehabilitation of Freshwater Fisheries. Fishing News Books. Blackwell Scientific Publications. Oxford.

HICKS, F. J. 1976. Smoke Lake chosen for trout experiment. The Wigwam 11(21) : 1-3.

A unique lake trout study is now well underway in Algonquin Park. The project consists of netting lake trout, now spawning in Smoke Lake, raising them in the Petawawa Hatchery, and returning them to their natal lake one and two years from now. The principal difference between this and normal lake stocking programs is that the hatched fry will be returning to the very lake to which their ancestral parents have had thousands of years to adapt. Ministry of Natural Resources biologists suspect that the resultant fry will show marked improvement in adaptability, and, hence, rate of survival.

HICKS, F. J. 1982. Summer creel survey of Smoke, Louisa, Aylen, Bark and Lavieille lakes, 1976-1979. File Report. Algonquin Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Whitney, Ontario. 94 p.

Bark Lake, in addition to exploitation, has been stocked regularly since 1966 as well as undergoing an annual drawdown by Ontario Hydro. The most obvious stress to the present fishery, although management oriented, is stocking. During 1977, the fork length distribution indicates several very strong size classes comprised primarily of marked lake trout. Eighty-five percent of these lake trout were in age class 7, marked with an adipose clip and presumably stocked in 1973. Overall, marked lake trout in the 1977 creel amounted to 64.8%. In 1976 and 1979, stocked lake trout represented 53% and 39%, respectively, indicating the impact of hatchery fish and the effect of various successful plantings in the Bark Lake fishery.

HICKS, F. J. 1985. Creel surveys, 1976-1982. File Report. Algonquin Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Whitney, Ontario.

Lake trout is the major sport fish of Bark Lake and the lake has been stocked regularly since 1966 to compensate for loss of natural reproduction from an annual drawdown of 10 m by Ontario Hydro. Marked lake trout represented 27% of the catch during 1980. In the past, the percentage of marked fish in the creel has ranged from 39.2-64.8%. Several plantings in recent years were unmarked which serves to mask the impact of lake trout stocking on the angler harvest as well as the possible presence of naturally reproducing lake trout.

Smoke Lake, located in Algonquin Park, is another heavily utilized lake trout lake which has been stocked on a regular basis. Based on six creel surveys between 1977 and 1982, hatchery-reared lake trout have contributed from 0-14% of the total lake trout catch.

HIMBURG, G. 1971. Winter creel census on Perry Lake. File Report. Ontario Ministry of Natural Resources. Timmins, Ontario.

Between 1960 and 1971 Perry Lake has been stocked with lake trout on six occasions. A winter creel census conducted during the winter of 1971 recorded 114 anglers harvesting 91 lake trout. The lake trout catch-per-effort (CUE) was 0.117. The contribution of hatchery-reared fish to the fishery is clearly indicated. Fifty-seven percent of the total catch was hatchery-reared fish. One hundred percent of the age IV fish were stocked fish. It is apparent that the natural reproduction of lake trout in 1967 did not contribute to the fishing success of the 1971 season.

HINDAR, K., N. RYMAN and F. UTTER. 1991. Genetic effects of cultured fish on natural fish populations. Canadian Journal of Fisheries and Aquatic Sciences 48 : 945-957.

This paper addresses the genetic consequences of aquaculture on natural fish populations. The study is motivated by rapidly increasing numbers of intentionally and accidentally released fish and is based on empirical observations reported in the literature. A wide variety of outcomes, ranging from no detectable effect to complete introgression or displacement, has been observed following releases of cultured fish into natural settings. Where genetic effects on performance traits have been documented, they always appear to be negative in comparison with the unaffected native populations. These findings are consistent with theoretical considerations of the implications of elevated levels of gene flow between cultured and locally adapted natural populations; they raise concerns over the genetic future of many natural populations in the light of increasing numbers of released fish. Strategies for the genetic protection of native populations from the effects of aquaculture are outlined including more secure containment, the use of sterilized fish and modifying the points of rearing and release. We recommend strong restrictions on gene flow from cultured to wild populations and effective monitoring of such gene flow.

HITCHINS, J. R. and W. G. A. SAMIS. 1986. Successful reproduction by introduced lake trout in ten northeastern Ontario lakes. North American Journal of Fisheries Management 6(3) : 372-375.

Ten inland lakes in northeastern Ontario, ranging in size from 59 to 663 hectares, were surveyed and found to be suitable for but devoid of lake trout (*Salvelinus namaycush*). Subsequently, hatchery-reared fin-clipped lake trout were introduced into each of the lakes between 1971 and 1975. Netting assessments in 1981 and 1982 captured unclipped lake trout in all 10 lakes. A total of 376 naturally reproduced fish were caught, ranging in age from 1 to 5. This study documents successful reproduction of hatchery-reared lake trout and the establishment of apparently self-sustaining lake trout populations.

HOFF, M. H. and S. P. NEWMAN. 1995. Comparisons of fingerling and yearling lake trout introductions for establishing an adult population in Pallette Lake, Wisconsin. North American Journal of Fisheries Management 15(4) : 871-877.

The comparative success of fingerling and yearling introductions in establishing a population of adult lake trout (*Salvelinus namaycush*) was assessed during 1982-1992 in 71 ha Pallette Lake, Wisconsin. In all, 25,350 lake trout were stocked in six lots of 4,225 each during 1982-1986. These lots comprised three cohorts (1982, 1984 and 1985), and each cohort included a fall fingerling stocking and a spring yearling stocking. Spring yearlings from the 1982 and 1985 cohorts survived to 1991 and 1992 in significantly larger proportions than fall fingerlings from the same cohorts. However, only 1.5 and 0.8% of all yearlings and only 0.5 and 0.2% of all fingerlings stocked survived until October 1991 and 1992, respectively. The cost of each yearling-stocked fish present in October 1991 was US$33.90 and was $61.54 in October 1992, whereas comparable costs for each fingerling-stocked fish were $47.28 and $113.14. We recommend that spring yearling lake trout be stocked instead of fall fingerling fish in inland Wisconsin lakes.

HOLLOWAY, A. D. 1945. Summary of trout stocking experiments. Fisheries Leaflet 137. U. S. Fish and Wildlife Service. Washington, D. C. 16 p.

HOLMES, W. J. 1966. Special lake trout study on Ranger Lake Sault Ste. Marie district. File Report. Ontario Ministry of Natural Resources. Sault Ste. Marie, Ontario. 3 p.

A three year creel census on Ranger Lake, which started in 1959, provided information for a special lake trout study. Spawn was taken for three years (1961, 1962, and 1963). Restocking of 10,000 yearling lake trout occurred in 1962, 1963 and 1964 for each year that spawn was taken. A complete lake survey was done in 1966.

HOYLE, J. 1990. Eastern region "native" lake trout experimental stocking project. File Report. Ontario Ministry of Natural Resources. Kemptville, Ontario. 8 p.

Fifty-three inland lakes in eastern Ontario are currently managed for lake trout. Thirty-three of these support significant natural reproduction. The remaining twenty are considered "holding basins" with varying possibilities for rehabilitation to naturally reproducing fisheries. Lake trout have been stocked in the majority of these lakes for many years to supplement native stocks as well as to establish/maintain the species in some waterbodies. The premise was that "stocked" fish would contribute to angler harvest and/or yield to the spawning population and ultimately increase total yield.

Five of these inland lake trout lakes have been monitored by the Rideau Lakes Fisheries Assessment Unit since 1980. Highlights of this monitoring program may be summarized as follows:

- Stocked lake trout grew more slowly than native lake trout in all lakes except Big Rideau.
- Stocked lake trout were of smaller sizes than native trout and contributed only 20-50% of the total annual yield.
- Total annual mortality rate was higher for stocked lake trout on all lakes.
- Stocked trout did not contribute significantly (i.e., < 5%) to the total annual lake trout yield on Devil Lake. However stocked lake trout did provide a significant contribution to annual yield amounting to 40-100% that of native trout on Big Clear, Big Rideau, Big Salmon and Charleston lakes.
- Stocked lake trout appear to provide little or no contribution to the spawning population in lakes supporting significant natural reproduction (i.e., Big Rideau 20%, N=49; Charleston 5%, N=110; Devil <2%, N=836).
- Stocked lake trout have traditionally performed particularly poorly in competition with the strong native lake trout population in Devil Lake.
- Genetic studies (allelic frequency differences) conducted on Charleston and Devil lakes detected a low frequency of introgression between native and stocked trout in Charleston and Devil lakes.

The role of lake trout stocking in the Eastern Region has recently been re-evaluated. As a result, the primary role of lake trout stocking will be to supply artificial fishing opportunities in holding basin lakes with good potential for rehabilitation. Stocking lake trout in lakes with significant natural reproduction will be de-emphasized as native populations increase in response to other management actions.

In this document, an experimental strategy is presented to implement and assess the stocking of native strain lake trout in three selected lakes with significant natural reproduction. The objective on two of the lakes (Big Rideau and Charleston) is to increase the contribution of stocked fish to the spawning population and thereby assist the native population to replace that portion of the lake trout fishery which is currently hatchery dependent. The objective on the third lake is to compare the performances of native strain fish hatched and raised in the hatchery with the Killala strain fish hatched and raised in the hatchery by performing a matched plant. The program is designed to commence with egg collections in 1987 and conclude in 2001.

HOYLE, J. and N. MacLEAN. 1988. Exploitation assessment of five southeastern Ontario lake trout populations supplemented by stocking. Rideau Lakes Fisheries Assessment Unit Report No. 18. Ontario Ministry of Natural Resources. Sharbot Lake, Ontario. 46 p.

The Rideau Lakes Fisheries Assessment Unit has collected trend-through time data since 1981 for five lakes supporting lake trout populations. Though natural reproduction in these lakes remains significant, native trout populations are supplemented annually by stocking yearling lake trout. In this report, we focus on data (angling effort and lake trout yield, abundance, mean age in the anglers harvest, mortality, and growth) collected during creel surveys conducted annually and biennially for winter and summer lake trout seasons respectively from 1981 to 1986.

Four of the five lakes (Big Clear, Big Rideau, Big Salmon and Charleston) relied heavily on stocked lake trout, roughly 40-60% by number of the total annual lake trout harvest. The contribution of stocked lake trout to the total annual lake trout yield was somewhat less due to the smaller size of stocked fish, ranging from 28-50% for the same lakes. By contrast, few stocked fish were angled from Devil Lake (about 10% by number and 5% by weight).

Angler harvest-per-unit-of-effort (HUE) for stocked fish showed less year-to-year variation in all lakes except Devil. This result may suggest that natural variation in the recruitment of native fish in these four lakes may be greater than the variation in stocking rates which are fairly constant from year to year. Total annual mortality rates were greater for stocked lake trout than native lake trout in all lakes. Stocked lake trout grew more slowly than native lake trout in all lakes except Big Rideau. Thus, although stocked lake trout recruited to the fisheries at the same age, they were of smaller size. Stocked lake trout disappeared from the fishery at lower ages than native fish.

In this study, differences between native and stocked lake trout (i.e., higher yields, faster growth and possibly lower natural mortality for native lake trout) clearly demonstrate the benefits of managing for native stocks.

HUGHSON, D. R. 1965. Report on the Panache (Penage) Lake 1965 winter angling success. File Report. Ontario Department of Lands and Forests. Sudbury, Ontario. 6 p.

During the winter of 1965, 487 anglers fishing for 2136 hours caught 154 lake trout. This figure represents approximately 30% of the total catch and effort for the winter of 1965. The large number of 8-14 inch lake trout appearing in the angler's catch (a result of 1962 and 1963 lake trout stocking of 16,000 and 10,000 yearlings, respectively, or perhaps two years of good natural reproduction) is providing 60% of the winter trout fishery. It appears possible at the present time that the Penage Lake lake trout fishery has been substantially improved by the introduction of hatchery stock. If future lake trout plantings in Penage Lake could be made with marked fish, it would determine the importance of hatchery fish in the angler's catch and also yield information on natural reproduction.

HUGHSON, D. R. 1966. Report on the Panache (Penage) Lake 1966 winter angling success. File Report. Ontario Department of Lands and Forests. Sudbury, Ontario. 6 p.

During the winter of 1966, 712 anglers fishing for 3,515 hours caught 319 lake trout on Penage Lake. This would represent approximately 30% of the total catch and effort for the winter of 1966. Small trout continue to make up the major portion of the anglers' catch. The 1966 planting of marked lake trout will assist in establishing the origin of the immature trout caught by the winter angler.

HUTCHISON, D. 1981. A future for lake trout. Freshwater Catch 11 : 4-5.

Lake trout, more commonly referred to in New Zealand as Mackinaw, were introduced from North America by the then Tourist Department in 1906 as a single importation of 50,000 ova. These were then hatched in the North Canterbury Acclimatisation society hatchery, Christchurch, and the following year 4,000 of the young fish were released in Lakes Pearson and Grassmere. A similar number destined for lake Kaniere on the West Coast were evidently lost before reaching the lake.

Although Pearson and Grassmere already supported stocks of brown trout, lake trout became established and for some years fared reasonably well in Lake Pearson. Since the mid 1950s the few anglers records available indicate a steady decline in size, condition and weight of fish taken from Lake Pearson. Lake trout have not been reported from Lake Grassmere for at least a decade and the species is no longer considered to exist there. Competition for both food and habitat may have limited the lake trout.

HYNES, J. D., E. H. BROWN, Jr., J. H. HELLE, N. RYMAN and D. A. WEBSTER. 1981. Guidelines for the culture of fish stocks for resource management. Canadian Journal of Fisheries and Aquatic Sciences 38 : 1867-1876.

Examples of desired genetic changes produced in fish by selective breeding are contrasted with those of unintentional and often harmful genetic changes resulting from artificial propagation over a prolonged period (e.g., reduced longevity and reduced temperature tolerance). Evidence of undesired effects caused by the hatchery environment on captive fish stocks is also presented (e.g., precocity, inappropriate feeding behavior) and the risks posed by artificial rearing techniques are discussed. Methods for identifying both genetic and environmentally induced changes are outlined along with experimental designs for distinguishing between them. Some practical recommendations are offered for establishing, developing and maintaining brood stocks in hatcheries and for managing wild fish populations in ways that maximize genetic variability while avoiding the occurrence of undesirable changes. Adherence to the recommended procedures will improve progress in fisheries rehabilitation efforts.

IHSSEN, P. E., M. J. POWELL and M. MILLER. 1982. Survival and growth of matched plantings of lake trout (*Salvelinus namaycush*), brook trout (*Salvelinus fontinalis*) and lake x brook F_1 splake hybrids and backcrosses in northeastern Ontario lakes. Ontario Fisheries Technical Report Series No. 6. Ontario Ministry of Natural Resources. Toronto, Ontario. 12 p.

Matched plantings of lake trout (*Salvelinus namaycush*), F_1 splake hybrids and lake trout backcrosses, and brook trout (*Salvelinus fontinalis*), F_1 splake hybrids and brook trout backcrosses were made annually in four small northeastern Ontario lakes for three successive years. The relative performance of the three different crosses in each lake was assessed by gillnetting in the fall, for seven consecutive years. F_1 hybrids were recovered at rates two to three times greater than the backcrosses, brook trout or lake trout, from all lakes, except one, where only one lake trout to 346 F_1 hybrids was recovered. The number of kg recovered per kg planted ranged from 2.5 to 4.4 for the F_1 hybrids, 0.3 to 1.3 for the backcrosses, and 0.0 to 1.0 for the brook trout and lake trout. The first planting gave the best returns, both in terms of numbers and kilograms recovered; the middle plant the poorest. The growth rates, recoveries, and condition factors were correlated among crosses, lakes and plantings. The plantings, crosses or lakes that gave the highest returns also gave the fastest growth rates and the largest condition factors. The F_1 hybrids from the two lakes that gave the fastest growth and highest rates of return matured significantly earlier in life (50% mature at about age 2.5 to 3.0, sexes combined) than those from the two lakes with the slower growth and lower returns (age 3 to 3.5)

IRVINE, R. L. 1965. Lake trout population study of Charleston Lake, Leeds County, October, 1965. File Report. Ontario Ministry of Natural Resources. Kemptville, Ontario. 35 p.

This report covers the first of a proposed annual series of studies of the lake trout (*Salvelinus namaycush*) population in Charleston Lake, Leeds County. The objectives are to determine the causes of population fluctuations and in annual angling success. It was conducted from September 22nd to October 25th, 1965. During the survey 176 lake trout (which had been planted in previous years), averaging 27.0" in total length, were captured, in trap and fine mesh gill nets, measured, scale sampled, tagged and released.

Information contained herein includes spawning dates and movements, weather conditions, air and water temperatures, efficiency of capturing equipment, mortality, egg predation, description of spawning areas, and age analysis data.

Scuba divers were employed to plot the egg disposition to determine the effects of water drawdown. A total of 93.2% were located at depths between 3 feet and 4.5 feet. None was found in less than 2.5 feet, or over 5 feet of water.

IRWIN, K. 1983. A summary of a 100% winter creel census on three oligotrophic lakes in the Bancroft District. Fisheries Management Report 1983-04. Ontario Ministry of Natural Resources. Bancroft, Ontario.

A winter creel census was conducted on three lake trout lakes (Anstruther, Faraday and Silent) during the winter of 1983. The study lakes have been stocked with yearling lake trout for the past several years. Creel census data show the return on stocked fish. Approximately 90% of the trout caught from Anstruther Lake over the course of the winter creel were native lake trout. The stocked lake trout added little to angling success. Silent Lake, on the other hand, had nearly 50% stocked fish contributing to the catch Most of the native fish were caught during the last two months of the creel period. The Faraday Lake catch consisted of 60% native trout and 30% stocked fish (10% unknown).

IRWIN, K. 1985. A summary of a spring creel survey on Eels Lake and a spring-summer creel survey on Wollaston Lake, 1984. Fisheries Management Report 1985-04. Ontario Ministry of Natural Resources. Bancroft, Ontario.

During 1984, an intensive spring creel survey was conducted on Eels Lake and a spring-summer creel was operated on Wollaston Lake. Hatchery-reared lake trout made up a significant portion (28%) of the spring harvest of Eels Lake while on Wollaston Lake stocked trout represented a minor portion (8%) of the lake trout harvest.

IRWIN, K. 1989. A summary of intensive open water creel surveys in the Bancroft District, 1986-87. Fisheries Management Report 1989-01. Ontario Ministry of Natural Resources. Bancroft, Ontario.

A total of 78 lake trout were sampled during the spring and summer on Anstruther Lake. The lake trout catch was comprised predominantly of fish which were 4-7 years of age. Only four fish (5.1%) were of hatchery origin. On Bay Lake, a total of 13 fish were sampled. Six of these trout (46.2%) were stocked fish.

IRWIN, K. and J. BRISBANE 1988. A summary of a 100% spring and summer creel census on Silent Lake, 1985. Fisheries Management Report 1988-05. Ontario Ministry of Natural Resources. Bancroft, Ontario.

A creel census program was conducted on Silent Lake from May 14 to September 2, 1985. The 2,632 anglers interviewed during the creel program exerted an angling effort of 5,242 hours (38.12 hrs ha^{-1}). A total of 69 lake trout were sampled. Most (88%) of the lake trout catch consisted of immature fish. Hatchery-reared fish comprised only 6% of the sample indicating that stocked fish contributed very little to the spring and summer lake trout fishery during 1985.

IRWIN, K., J. BRISBANE and D. GILLAP. 1985. A summary of an intensive open water creel census on four Bancroft District lakes, 1983. Fisheries Management Report 1985-01. Ontario Ministry of Natural Resources. Bancroft, Ontario.

Three lake trout-bass lakes (Anstruther, Eels and Chandos) and one walleye-muskellunge lake were surveyed in 1983. Results indicate that lake trout anglers experienced the best success on Anstruther Lake while Eels and Chandos lakes provided fair and poor quality lake trout angling respectively. Although all three lakes are stocked with lake trout, domestic trout contributed substantially only to the anglers catch from Eels Lake. In Anstruther Lake, only 2 of 112 trout sampled (1.8%) were stocked fish.

JACOB, B. L. 1964. Artificial lake trout spawning bar, Higgins Lake, Roscommon County. File Report. Michigan Department of Natural Resources. Ann Arbor, Michigan. 4 p.

Lake trout captured during netting operations in Higgins Lake, Roscommon County, in recent years have demonstrated rather conclusively that natural reproduction of this species in this lake is of little consequence to the populations. Since 1947 all of the lake trout stocked in Higgins Lake have been marked by fin clipping. In 1958, of 177 lake trout examined, 156 or 88.1% bore recognizable fin clips. In 1959, of 185 lake trout examined, 130 or 70.3%, bore recognizable clips. In 1960, of 235 lake trout examined, 193 (82.1%) bore recognizable fin clips. In 1962, of 107 lake trout examined, 100 (93.5%) bore recognizable fin clips. Because of these observations and in view of Wisconsin's apparent success with similar projects, it was decided that an artificial lake trout spawning bar should be constructed.

JENSEN, R. E. and M. Y. CHEN. 1986. Feasibility of cage incubation of lake trout eggs in Lake Diefenbaker. Fisheries Technical Report 86-1. Saskatchewan Fisheries Laboratory. Saskatoon, Saskatchewan. 24 p.

Previous efforts to establish a lake trout population in Lake Diefenbaker with fingerling stocking have not produced a viable population. Earlier studies indicate habitat is not a limiting factor because 13% of Lake Diefenbaker's total water volume is suitable for lake trout. Preferred food for adult and juvenile lake trout are now present in Lake Diefenbaker. The feasibility of an alternative method of introducing lake trout was tested between October 1984 and May 1985.

A total of 4,000 fertilized lake trout eggs, obtained from Whiteswan Lake, were placed in baskets contained within two rigid aluminum cages. The cages were covered with screens to protect the eggs from predators and to prevent the hatched lake trout fry from escaping. On October 1, 1984, the cages were lowered to a depth of 10 m in the spillway channel of Gardiner Dam. At this depth the cages were below the maximum water drawdown level. The cages were lifted on May 2, 1985. A count of hatched lake trout indicated a 15-20% success rate.

The result of this experiment shows that lake trout eggs can be successfully incubated and hatched at a depth unaffected by the maximum water drawdown. The feasibility of producing a viable lake trout population in Lake Diefenbaker requires continuation of the experiment to ascertain that a sizable stock of juvenile lake trout can be established through cage incubation, homing of fish to the new spawning beds occurs at depths below water drawdown levels, and a sufficient area of spawning substrate at such depths is available to support the lake trout population.

We recommend that 200,000-500,000 lake trout eggs be collected and cage-incubated biannually for ten years, that angling and commercial fishing be monitored for catches of lake trout, and that artificial spawning beds be constructed once the return of lake trout to hatching sites is confirmed.

JORGENSEN, C. R. 1968. Preliminary observations on the lake trout of Lake Temagami. Ontario Department of Lands and Forests. Temagami, Ontario. 30 p.

JORGENSEN, C. R. 1971. Lake Temagami: Estimated total harvest, summer 1967 and 1968 and present trends of the lake trout fishery. Ontario Department of Lands and Forests. Temagami, Ontario. 33 p.

A more realistic estimated total harvest is presented for Lake Temagami for 1967 and 1968. However, this brings the estimated total harvest of lake trout to 0.85 lb per acre per year. Since the estimated production in trout waters is only 0.5 lb per acre, it appears that Lake Temagami is being over-harvested. This is further substantiated by a higher proportion of younger age classes being caught in the winter fishery year after year. In 1967, 94% of the trout caught in the winter were sexually immature, and in 1971, 25% of the trout caught were so small that they were not worthwhile keeping. The average weight of lake trout caught is decreasing. In the winter 1971, the average weight of a lake trout caught was 1.74 lb, while in 1958 it was 3.04 lb. Lake Temagami, therefore, is being over-fished and cannot sustain an increase in fishing pressure. Action must be taken immediately to reduce the harvest.

Lake trout stocking with yearlings has shown an insignificant contribution to the fishery. It is hoped that stocking with two-year-olds will produce a better recruitment of hatchery fish to the fishery.

JORGENSEN, C. R. 1973$_a$. A proposal for experimental lake trout stocking in Lake Temagami. Ontario Ministry of Natural Resources, Lake Nipissing – Temagami Fisheries Management Unit. North Bay, Ontario. 6 p.

Lake Temagami is a 53,318 acre lake in northeastern Ontario which provides a lake trout fishery. Creel census programs in the 1960s indicate that the lake trout resources was overexploited to the point that the existing lake trout population is in a fragile state.

Since 1961, 132,500 fin clipped yearling lake trout have been stocked in Lake Temagami yet only 17 clipped lake trout have been reported. During the summer of 1966, 390 lake trout were examined. None had been fin clipped but a stocked fish was reported caught with a front pectoral fin missing. Out of 483 fish examined during the winter of 1967 only one fish had an adipose fin clip. During the 1967 open water season, 805 lake trout were examined and only three fish were fin clipped. In the winter of 1968, 318 trout were examined and one was fin clipped. In the winter of 1969, 395 trout were examined but no clipped fish were encountered. During the winter of 1971, a total of 430 lake trout were examined and only two were stocked fish. With such poor results with stocked fish it may be concluded that the contribution of hatchery stocked lake trout to the fishery is insignificant.

An experimental lake trout stocking program is recommended. The project involves stocking the northeast arm of Lake Temagami with 100,000 yearling fish every other year and with 10,000 two year old fish every second year. Fish will be differentially marked and the results will be monitored by creel census and trap netting.

JORGENSEN, C. R. 1973$_b$. A summary of the five year study of the Lake Temagami lake trout fishery. Nipissing and Temagami Fisheries Management Unit. Ontario Ministry of Natural Resources. North Bay, Ontario. 106 p. + appendices.

Data is presented for the 1971 fishing season on Lake Temagami. Catch-effort statistics were summarized for the six-year period 1966-1971. The lake trout fishery was described from 1958 to 1971. Growth rates, age class composition, age for sexual maturity, length-weight relationship and total mortality rates were presented. The contribution of the annual lake trout stocking program was also determined for the plantings from 1961 to 1971.

Creel census results from 1966 to 1971 showed that over-exploitation of the lake trout took place in 1966, 1967 and 1968. There was no data to estimate the annual harvests for 1969 and 1970. In 1971 the trout harvest decreased mainly because three fishing camps closed down.

From 1958 to 1971, lake trout fishing pressure increased year after year except for the summer of 1971. While the fishing pressure was increasing the size and weight of the angler caught trout was decreasing. In winter the average weight dropped from 3.8 lb in 1967 to 2.9 lb in 1971. Also more sexually immature trout were caught each year. In 1961 the number of sexually immature trout taken was insignificant while 83.7% of the 1971 winter harvest and 56.2% of the summer harvest were immature.

Lake trout stocking with yearlings has shown an insignificant contribution to the fishery. Since 1961, one hundred and thirty-two thousand, five hundred (132,500) fin-clipped yearlings have been stocked in the lake. Three thousand, three hundred and twelve (3,312) trout have been examined for clipped fins and only seventeen (17) were found.

The increased harvest of whitefish may be the result of decreased predation resulting from a decrease in older lake trout. If the increase in rate of exploitation is not stopped it will mean the eventual demise of the lake trout.

KAPUSCINSKI, A. R. and L. D. JACOBSON. 1987. Genetic guidelines for fisheries management. Department of Fisheries and Wildlife, University of Minnesota. St. Paul, Minnesota. 66 p.

It is possible that the fitness of stocked fish will be less than the fitness of the wild population residing at a particular location. Stocked fish could, for this reason, affect the fitness and long term adaptability of the population. Fitness will be reduced if the stocked fish are poorly adapted to the environment in which they are stocked and if the number of fish stocked is large relative to the number of fish produced by natural reproduction. Stocking carefully selected fish strains may be the only way, however, to restore fitness and ensure persistence of a depleted wild population.

It is recommended that, whenever possible, wild populations be managed so that stocking is unnecessary. When stocking is necessary, try to stock fish that are well adapted to the local environment. The best way to ensure that stocked fish will have high fitness in a particular environment is to use wild fish from the same environment as broodstock. If this is not practical, then broodstock should be obtained from environments as similar as possible to the environment into which fish will be planted.

KEIL, M. W. 1938. Developing trout and salmon fishing in lakes. Progressive Fish Culturist 41 : 1-8.

Good fishing for trout or salmon or both cannot be built up or maintained by dumping a few thousand fingerling fish into a lake of several thousand acres and then waiting for several years to see what happens. If best results are to be expected from these fish, they should be held over into the yearling stages before being planted. The number of trout and salmon in the yearling sizes that should be planted each season to provide good fishing must depend on the size of the lake, the proportion of shallow to deep water areas, the character and amount of the food supply and, to a large extent, on the quantity and condition of the fish removed by angling. Best results have followed the planting of yearling fish quite late in the fall when the surface and deeper waters are becoming more uniform in temperature. In lakes where the shore areas are frequented by large numbers of bass, pike or pickerel, it is best to tow these fish in a floating live box out over the deep water sections and release them a few at a time over considerable areas.

KENDALL, W. C. 1924. The status of fish culture in our inland public waters and the role of investigation in the maintenance of fish resources. Roosevelt Wildlife Bulletin 2(3) : 205-351.

Young lake trout should be planted in water deeper than 40 feet. This recommendation is not based on food requirements of the young fish but upon freedom from enemies at that depth.

KERR, S. J. 1977. Goldie Lake test netting, August 1977. File Report. Ontario Ministry of Natural Resources. Wawa, Ontario. 7 p. + appendices.

Lake trout were introduced to Goldie Lake, Ontario, with the release of 5,000 yearling fish in 1972. Subsequent plantings involved 5,000 yearling lake trout in 1973 and 20,000 yearling lake trout in 1976. Test netting was conducted between August 16-21, 1977 to evaluate the success of these stocking projects.

Two small mesh gill nets were set and lifted daily over a five day period. Nets were set below the thermocline in waters less than 8° C over a steeply sloping bottom in order to target age II fish. Only six age II lake trout were captured while six older (5+ to 6+) larger, trout were caught. It was difficult to attribute this poor catch to any specific reason. Having used a total of 3,500 feet of gill net one would normally expect a larger catch than that which was obtained. Due to our limited knowledge of bottom types in conjunction with the small sample size, it was impossible to draw any conclusions concerning bottom type preferences by the inhabiting lake trout.

KERR, S. J. 1980. 1980 winter creel census on Wawa Lake. File Report. Ontario Ministry of Natural Resources. Wawa, Ontario. 30 p. + appendices.

A winter creel survey on Wawa Lake was conducted from January 14 to March 23 1980. In sixty-two census days a total of 140 parties, comprised of 349 anglers, were interviewed. Only eighteen lake trout, 49 lake whitefish and 1 brook trout were observed during the entire survey. One marked lake trout, indicative of the 1977 experimental plan, was examined during the study. The absence of other age 4+ lake trout in the winter fishery is somewhat surprising since this is generally the minimum age when lake trout first enter the recreational fishery.

KERR, S. J. 1981$_a$. 1980 lake trout spawning investigation, Wawa Lake. File Report. Ontario Ministry of Natural Resources. Wawa, Ontario. 12 p. + appendices.

Investigations were carried out on Wawa Lake during three random evenings in October to record lake trout spawning activity and document spawning sites. Twenty-seven lake trout were netted. No planted lake trout were captured during this study.

KERR, S. J. 1981$_b$. 1981 winter creel census on Wawa Lake. File Report. Ontario Ministry of Natural Resources. Wawa, Ontario. 30 p. + appendices.

During a three month (January-March) winter creel census program on Wawa Lake a total of 282 fishing parties comprised of 609 anglers were contacted and interviewed. Anglers reported exerting 2298.2 rod hours (1422.6 person hours) of fishing effort to harvest a total of 15 lake trout and 102 lake whitefish. Only one planted lake trout, bearing an adipose fin clip and originating from the 1977 plant (1976 year class) was observed during the entire program. Similarly, only one hatchery-reared lake trout, originating from the same plant, was observed during the 1980 winter creel survey.

Although the 1979-1981 lake trout plantings cannot yet be expected to have contributed to the recreational lake trout fishery, it is somewhat disappointing to have only sampled on hatchery-reared lake trout originating from the 1977 plant. To date, only one planted lake trout (age 4+ in 1980; age 5+ in 1981) has been sampled in each of the past two years. Although the apparently poor results to date of the initial plant (1977) may be indicative of the actual survival and relative contribution of planted lake trout in Wawa Lake, it would be premature to speculate further until at least 1984 or 1985 when fish from the latter three plantings should be present in the fishery. It is interesting to note that, although intensive assessment projects were not conducted, fish originating from a June 1971 plant of 6,000 yearling lake trout bearing a right pectoral (RP) fin clip have never appeared in any experimental netting or creel census programs to date.

KERR, S. J. 1982. 1982 winter creel census on Wawa Lake. File Report. Ontario Ministry of Natural Resources. Wawa, Ontario. 20 p.

During a three month (January-March) winter creel census program on Wawa Lake, a total of 128 ice fishing parties (233 anglers) were contacted and interviewed. Angers were observed to exert 780.25 rod hours of fishing effort to catch 10 lake trout, 94 lake whitefish and 1 brook trout. Only two of the ten sampled lake trout were found to be marked with an adipose fin clip indicative of their hatchery origin. The fish were both found to be age 4+ having been planted in 1977.

KERR, S. J. 1983. Gillies Lake: Current status of the lake trout fishery and management proposals for the future. Management Report. Ontario Ministry of Natural Resources. Owen Sound, Ontario.

Based on the earliest records available, several pails of fertilized lake trout eggs were transferred from the Wingfield Basin of Georgian Bay to Gillies Lake in 1892 or 1893. By 1889 local anglers were reporting catches of lake trout. Over the years planted fish species have included lake trout, brook trout, Kamloops trout, splake, rainbow trout and ouananiche. Gillies Lake has been planted with lake trout on a regular basis since the 1940s. A number of strains, including Manitoba, Lake Manitou, Lake Simcoe and Killala Lake, have been released in the lake.

Based on creel census information collected on an irregular basis since 1957, the contribution of planted (fin clipped) lake trout to the creel has ranged from 2.9-100.0% (N=7). Since the late 1970s, hatchery-reared lake trout have comprised from 60-80% of the fish caught by anglers.

In order to supplement and restore existing stocks, it is recommended that yearling lake trout be planted annually in Gillies Lake. In addition to disease-free status, some consideration should be given to minimizing the number of different strains of lake trout which are planted in Gillies Lake. The planting of alternate fish species, such as rainbow trout, should be discontinued immediately.

KERR, S. J. 1985. Gillies Lake volunteer creel census program, winter 1985. File Report. Ontario Ministry of Natural Resources. Owen Sound, Ontario. 8 p.

For the second consecutive year, a volunteer creel census program was carried out during the winter fishing season on Gillies Lake. Ice hut fishermen reported exerting 305.0 man-hours (683.5 line hours) of angling effort to catch a total of 135 fish. Lake trout comprised 86.7% of the reported catch. Anglers reported releasing 27% of the lake trout caught. The mean size of lake trout, which were caught and kept, was 13.5 inches (34.3 cm). Fin clipped fish accounted for 64.3% of the lake trout harvest. It is recommended that a similar program be initiated during the winter of 1986.

KERR, S. J. 1986. Gillies Lake volunteer creel census program, winter 1986. File Report. Ontario Ministry of Natural Resources. Owen Sound, Ontario. 11 p. + appendices.

The 1986 program represents the third consecutive year that a volunteer creel census program has been conducted on Gillies Lake. Anglers reported expending 910.5 (rod) hours of fishing effort to catch 109 lake trout and 3 lake herring. Forty-five lake trout (65.2% of the catch) were recorded as bearing a fin clip indicating their hatchery origin. Six different fin clips were recorded in the catch. Stocked trout first entered the Gillies Lake fishery at age III.

KERR, S. J. 1991. Results of a 1991 winter survey of lake trout and splake fisheries, Eastern Region. File Report. Ontario Ministry of Natural Resources. Kemptville, Ontario. 22 p. + appendices.

For the third consecutive year, an aerial creel survey supplemented by on-the-ground angler interviews was conducted on splake fisheries in Divisions 9 and 10 as well as lake trout and splake fisheries in Division 29. During a three week season in March (March 9-31) an estimated 33,914.6 angler hours of fishing effort (4.37 angler hours/ha) were expended on thirty lake trout lakes in Division 29. An estimated 3,222 lake trout were harvested during that period. As noted in earlier surveys, the overall lake trout catch was split almost evenly between native (44%) and stocked (46%; 10% unknown) fish. The contribution of stocked fish to the winter fishery ranged from 14% (Barker Lake) to 100% (Camp Lake).

KERR, S. J. 1992. Results of an aerial creel survey of lake trout and splake fisheries in Divisions 9, 10 and 29 during the winter of 1992. File Report. Ontario Ministry of Natural Resources. Kemptville, Ontario.

An aerial survey was carried out on sixty inland lake trout and splake lakes in Divisions 9, 10 and 29 during the open season in February and March of 1992. Winter lake trout angling pressure remained high in Division 29. March angling effort directed at lake trout was estimated at 28,195.9 angler hours. This value probably represents an underestimate since winter angling activity continued well into the month of April. The estimated lake trout harvest was 2,594 fish. Lake trout catch rates have remained relatively constant during the past four years however the proportion of hatchery-reared fish in the catch has increased annually since 1990. The proportion of stocked lake trout in the catch ranged from 0% (Crystal Lake) to 100% (Reid Lake). Five different fin clips were recorded in the catch.

KERR, S. J. 1999. An interim evaluation of "native" strain lake trout stocked in Charleston Lake, Ontario. Manuscript Report. Southcentral Sciences Section, Ontario Ministry of Natural Resources. Kemptville, Ontario. 9 p.

The low contribution of various stocked strains of lake trout to the spawning population and the recognition that the native strain of lake trout may be genetically unique prompted fisheries managers to evaluate the feasibility of collecting, rearing, and stocking progeny of the original native strain of lake trout back into Charleston Lake, Ontario. This experimental project was initiated to comparatively evaluate the performance of the "native" strain of lake trout in Charleston Lake. Performance was evaluated based on survival and growth, contribution to the recreational fishery and, perhaps most importantly, to the spawning stock.

Four separate egg collections (1987, 1988, 1993, and 1994) were carried out during this project. Reproductive products were only taken from unmarked lake trout which were assumed to be "native" in origin. Fertilized eggs were incubated in an isolation facility at the White Lake Fish Culture Station. Fish were reared to 15-16 months of age when they were stocked in the spring. All fish were differentially marked (fin clipped) for future recognition.

During an intensive creel in the open water fishery of 1997, 68.4% (N=237 fish) of the catch were hatchery reared fish (all strains combined). Native strain lake trout from the 1988 and 1989 year classes which had been stocked in 1989 and 1990 respectively accounted for 23.6% of the total catch.

Spawning surveys were conducted annually between 1993 and 1998. Stocked male trout first appeared in small numbers at four years of age. The contribution of the first two year classes of stocked fish appeared to peak in 1997 and 1998 when trout had achieved 8-10 years of age. These fish made substantial contributions to the spawning stock especially in 1997 when they accounted for 50% of the fish sampled.

Overall, native strains of hatchery-reared lake trout have made important contributions to both the recreational fishery and to the resident lake trout spawning population. This information should be utilized to develop a long term stocking strategy for Charleston Lake. It is recommended that, in order to sustain a popular recreational fishery based predominantly on natural reproduction and to preserve the genetic integrity of lake trout in Charleston Lake, the stocking of non-native strains be discontinued. Future stocking programs on Charleston Lake should involve the use of fish derived from the native gene pool of resident lake trout.

KERR, S. J. and R. E. GRANT. 2000. Potential impacts of lake trout introductions. p. 271-272. *In* Ecological Impacts of Fish Introductions: Evaluating the Risk. Fish and Wildlife Branch, Ontario Ministry of Natural Resources. Peterborough, Ontario.

Some of the most severe consequences of lake trout (*Salvelinus namaycush*) introductions have occurred in the midwestern United States. Introduced lake trout have had negative impacts on resident salmonids including Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*), bull trout (*Salvelinus confluentus*), Sunapee trout (*Salvelinus alpinus*) and other lake trout. Most interaction with other species regards either predation or competition for food. Lake trout are known to hybridize with Arctic charr (*Salvelinus alpinus*), brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*). Lake trout are also known to be host to several parasites and susceptible to several diseases.

KILBY, M. 1982. Winter creel census on Galeairy, Gliskning, Lobster and McCauley lakes, 1982. File Report. Ontario Ministry of Natural Resources. Whitney, Ontario.

Fishing effort was very low as well as the catch and catch-per-unit-of-effort (CUE) for all lakes sampled. Of the 5 lake trout sampled only two had left ventral and adipose fin clips. These were lake trout of the Smoke Lake strain and both came from McCauley Lake. Too few fish were encountered in the survey to adequately assess the relative success of the two strains of lake trout.

KINCAID, H. L. 1995. Development of a hatchery broodstock for recovery of Green Lake strain of lake trout. American Fisheries Society Symposium 15 : 562-563.

The Green Lake (Wisconsin) strain of lake trout (*Salvelinus namaycush*) the last remnant of historic southern Lake Michigan deepwater spawning strains, was discontinued as a hatchery broodstock after the 1975 year-class was stocked into Lake Michigan in 1976. In 1982, a decision was made to preserve the gene pool of the Green Lake strain in a captive brood stock developed from feral fish recaptured from Black Can Reef and Julian's Reef in southern Lake Michigan. Between 1986 and 1988, 24 females and 31 males were captured from the 1976 stocking and spawned in five progeny groups. A sixth group was produced from a remnant of the Green Lake broodstock at the Genoa (Wisconsin) National Fish Hatchery

Broodfish from four of the six progeny groups were transferred to the Iron Lake National Fish Hatchery in 1991, where a two-stage breeding plan was initiated to develop a composite Green Lake broodstock. In 1991, a diallel mating design was imposed to equalize matings among groups and to equalize the genetic contribution of each group. At the eyed stage, 110 eggs were removed from each family and placed in a pool for rearing to maturity. This procedure was repeated in 1992, except lots were sampled at the swim-up stage, and 3-100 fish from each lot were pooled. When the fish reach maturity in 1998, a reciprocal-crossing design will require that a minimum of 100 matings of 1991 year-class males with 1992 year-class females and 100 matings of 1991 year-class females with 1992 year-class males be used to construct the final broodstock. The breeding plan used to develop the new Green Lake broodstock will not recreate the original Green Lake strain, but it will preserve the remaining genetic variation from this unique gene pool.

KINCAID, H. L. and G. T. CALKINS. 1992. Retention of visible implant tags in lake trout and Atlantic salmon. Progressive Fish Culturist 54 : 163-170.

Retention and readability of visible implant (VI) tags were evaluated in adult (2-year old) Atlantic salmon (*Salmo salar*), adult (4-year old) lake trout (*Salvelinus namaycush*) and yearling (10 month old) fish of both species. Tags were implanted in adipose eyelid tissue posterior to the eye. After 10 months, retention in yearlings was 49% by Atlantic salmon and 41% by lake trout. In adults, retention was 84% by Atlantic salmon and 45% by lake trout. Tag retention in yearling Atlantic salmon increased with fish weight at tagging; tag retention by weight groups was 0% for fish that weighed 20 gm or less; 46% for 21-40 gm fish; and 71% for 41-99 gm fish. Tag retention in adults of Atlantic salmon and lake trout was not related to fish weight. After 10 months, the percentage of readable tags was 100% in yearling Atlantic salmon and 82% in adult Atlantic salmon and 0% in yearling lake trout and 77% in adult lake trout. None of the tags in yearling lake trout were readable 294 days after implant because of cloudiness of the adipose eyelid tissue. Tags recovered from fish with cloudy adipose tissue were readable. The proportion of total tag loss occurring in the first 70 days after tagging was 78% in yearling Atlantic salmon and 22% in adult Atlantic salmon and 67% in yearling lake trout and 41% in adult lake trout. The tags were effective for Atlantic salmon larger than 30 gm but they were not effective for lake trout.

KINCAID, H. L., C. C. KRUEGER and B. MAY. 1993. Preservation of genetic variation in the Green Lake strain lake trout derived from remnant domestic and feral populations. North American Journal of Fisheries Management 13(2) : 318-325.

The Green Lake, Wisconsin, strain of lake trout (*Salvelinus namaycush*) was discontinued as a hatchery brood stock in 1976 after lake Michigan was stocked with the 1975 year-class. In 1982, a decision was made to restore the Green Lake strain as a production brood stock. Five groups were produced by spawning marked fish that were survivors from the 1976 stocking of southern Lake Michigan. A sixth group was produced from a remnant of the Green Lake brood stock held at the Genoa (Wisconsin) National Fish Hatchery. Hatchery accidents reduced both the number of groups and the effective population number of each group. We studied a procedure for reconstructing a composite Green Lake brood stock from individuals of these six groups. Genetic variability was evaluated by allozyme electrophoresis in five of these groups. Twelve of 18 loci were polymorphic. Allelic frequencies were similar in all five groups; however, significant differences occurred in nine systems. Heterozygosity level (mean + SE) was lowest in the domestic group (0.119 + 0.043) and ranged from 0.139 + 0.043 to 0.166 + 0.052 in the feral groups. Cluster analysis of genetic distances grouped the four feral groups together, but separate from the domestic group. Progeny from fish captured on Black Can Reef, Lake Michigan, in 1986 and 1988 were the most similar. A modified diallel mating design was developed to produce a composite brood stock from remnant feral and domestic fish. Pooled families from 1991 and 1992 diallel matings will be reared to maturity, then reciprocal crosses of the two year-classes will be made to form the new composite Green Lake brood stock.

KOOYMAN, A. H. 1971. Prairie parks. p. 62-64. *In* Canadian Wildlife Service 1971. Canadian Wildlife Service, Ministry of the Environment. Ottawa, Ontario. 87 p.

The lake trout population in Crean Lake has been low for the past 25 years perhaps because of overexploitation by commercial fishermen and subsequent low reproduction in years when spawning reefs were not adequately covered with water. Over 2,000 marked adult fish were transferred in the 1950s and 1960s from Wassegam Lake in the northern part of the park to Crean Lake. Angling in Crean Lake improved only in 1968 when about 300 trout were caught mainly from one deep area. Adults transferred to the lake in 1964 and 1966 comprised a large proportion of the catch.

Stocking of Clear Lake with fingerling lake trout began in the 1920s. Transfers of adult trout from Clearwater Lake in northern Manitoba began in the 1940s. Yearling lake trout have been transferred from the Maligne River hatchery several times since 1950. Hundreds of adult trout move into a spring fed stream at the east end of Clear Lake each fall and leave again before spawning. Their presence confirms the survival of planted fish marked at stocking time. Lake trout are evidently not reproducing successfully in Clear Lake. Young fish are rarely seen and those that have been examined usually bear marks indicating they are survivors from hatchery plantings. Spawning grounds for lake trout are abundant in the lake. It is virtually certain that the trout spawn normally but hatching success seems to be very limited. The species is otherwise well adapted to Clear Lake as is shown by the survival and excellent condition of the planted fish.

KRISHKA, B. A. 1995. Status of the Charleston Lake sport fishery. Rideau lakes Fisheries Assessment Unit update 95-3: Ontario Ministry of Natural Resources. Sharbot Lake, Ontario. 5 p.

The sport fishery of Charleston Lake has historically focused on lake trout. The lake has a long stocking history beginning in 1888 with lake trout and lake whitefish fry. Angling pressure on Charleston Lake was considered excessive during the early 1980s and led to the closure of the winter fishing season by 1987. Based on creel surveys conducted regularly since 1981, stocked trout represent about 60% of all harvested trout and overall fewer native trout are being kept. The higher mean age and smaller mean weight of native trout in recent years suggests the population is still highly stressed. The importance of stocked fish in sustaining the trout fishery will remain until further measures are taken to control effort and harvest. Unfortunately, continued stocking is expected to further stress the native trout population.

KRUEGER, C. C. and B. MAY. 1991. Ecological and genetic effects of salmonid introductions in North America. Canadian Journal of Fisheries and Aquatic Sciences 48 (Supplement 1) : 66-77.

Stocking of non-native Salmoninae into North American waters began around 1870. Introductions of native salmonids within North America but outside their native ranges have been common. Lake trout (*Salvelinus namaycush*) have established populations in western North American lakes such as Lake Tahoe, Nevada and Lewis Lake, Wyoming, but naturalized populations of this species are less widespread outside its range than the brook trout. Ecological impacts of salmonid introductions include competition, predation on native salmonids and other fishes, and introduction of parasites and diseases to native fish. Direct genetic effects from stocked salmonids are caused by interbreeding with native species. Indirect genetic effects may result through selective forces and/or a reduction of effective population size, genetic drift and inbreeding. Salmonid stocking as a management practice is appropriate for species or population rehabilitation. Continued stocking of non-native salmonids should cease where viable native salmonid populations exist. The ear of widespread, intentional introductions of salmonids by man justifiably is drawing to a close.

KRUEGER, C. C. and W. C. SHEPHERD. 1997. Predation by alewife on lake trout fry emerging from laboratory reefs. p. 12. *In* 1997 Annual Report Coldwater Fishery Research Program, Cornell University. Ithaca, New York.

Predation by alewife (*Alosa pseudoharengus*) may be an important source of mortality on lake trout (*Salvelinus namaycush*) fry and could affect the success of lake trout restoration in the Great Lakes. The objectives of this study were to determine whether alewife could feed upon fry that exhibited natural behavior, to compare the survival rates of fry in the presence and absence of alewife, and to estimate the mean daily consumption rate of fry by alewife over a 12 day period. Each of six tanks containing cobble substrate were maintained under natural photoperiod and stocked with 153 lake trout fry, a density reported at Stony Island reef in Lake Ontario. Four treatment tanks each contained ten alewives. The two tanks without alewives served as controls.

After 12 days, mean recovery of fry was much less in the treatment that contained alewife (31.5 fry per tank) than in the control tanks (150 fry per tank). Mortality in the control tanks was about 2% in contrast to the 46-91% mortality experience in tanks with alewives. The effects of predation by the alewives were evident early in the experiment because the mean daily capture of fry by traps set in each tank was always lower after day two in treatment tanks than in control tanks. Alewife consumption rates of lake trout fry ranged from 0.57 to 1.16 fry per alewife per day with a mean of 0.99 and a median of 1.12. The results of this study support the contention that predation by alewife could provide a high level of lake trout fry mortality and thus affect natural recruitment of lake trout and the success of population rehabilitation.

KUMMU, P. and T. SORMUNEN. 1974. Lake trout (*Salvelinus namaycush*) in Finland. Manuscript Report. Fisheries Foundation of Finland. 2 p.

LAFFERTY, B. 1980. Winter creel survey: Hearst District. File Report. Ontario Ministry of Natural Resources. Hearst, Ontario. 7 p. + appendices.

Between January 1 and April 19, 1980 a winter creel was conducted on several lakes, including Red Pine Lake, within the Hearst district. Red Pine Lake had been stocked with 2,000 lake trout yearlings in both 1976 and 1977. Red Pine Lake received an estimated fishing pressure of 1,291.6 hours and a harvest of 78 lake trout. It is recommended that Red Pine Lake be continued as a lake trout fishery.

LAKE TROUT ADVISORY WORK GROUP. 1990. Vermont's lake trout management plan for inland waters. Part III: A response to public comments on the proposed regulation changes and final recommendations of the lake trout advisory working group. Vermont Fish and Wildlife Department. Waterbury, Vermont. 216 p.

LAMBERT, R. S. and P. PROSS. 1967. Renewing nature's wealth: A centennial history. Ontario Department of Lands and Forests. Toronto, Ontario. 630 p.

The Province of Ontario remained out of the fish and game conservation picture until the 1890s. In the intervening period, the only fish conservation work was that carried on for the Dominion government by Samuel Wilmot at his fish hatchery, at Newcastle in Durham County, between 1868 and 1894.

For a better part of a century conservationists placed great faith on artificial fish breeding as a means of counteracting the effects of overfishing. In fact, it was looked upon as the answer to all fisheries problems. Hence the importance attached by government to fish hatcheries illustrated by the taking over by the

Dominion government and its long continued support of Samuel Wilmot's pioneering hatchery experiments at Newcastle. It was believed that the eggs of commercial species taken during spawning periods could be salvaged and hatched in jars and later returned to the water in the "eyed" state thereby ensuring the future of the fishery. From 1907 to 1946 the reorganized provincial Game and Fisheries Department gave its attention to restocking the waters of the province by establishing a Fish Culture Branch and acquiring some twenty fish hatcheries and fish rearing ponds.

For the best part of a century the federal government and then the provincial government operated such hatcheries. But there is not the slightest evidence that any planting of "eyed" eggs ever had any effect save in waters where the species was not found at all.

LA RIVERS, I. 1962. Lake trout. p. 258-264. *In* Fishes and Fisheries of Nevada. Nevada Fish and Game Commission. Reno, Nevada. 782 p.

Lake trout was introduced and well established in Lake Tahoe before the turn of the present century (plantings are known in Nevada for the years 1885 and specifically for Lake Tahoe in 1887, 1895, 1896, 1907 and 1908) and has contributed to sport fishing there ever since. Small plants made in the Tuckee River and Walker Lake in 1907-1908 failed.

In determining the suitability of waters where stocking with this species is contemplated depth, bottom type, temperature and oxygen cycles need to be considered. The lake trout requires deep waters which will stay cool and rocky bottoms with little or no decaying organic matter to deplete the oxygen content of the water.

Lake trout is not always considered the best trout either from the standpoint of gaminess or food qualities and hence its introduction into western waters already supporting native trout should be discouraged as a general rule. However the species has probably been unjustifiably condemned in Lake Tahoe as the immediate factor chiefly responsible for the decline of the native cutthroat trout there. While the lake trout undoubtedly would utilize some cutthroat as food, the formers predilection for deeper waters would remove it from too intimate contact with other trout; if the spawning streams tributary to Tahoe had been properly managed it is possible that the cutthroat might have held its own. There is some speculation that the 1922-1928 wholesale demise of cutthroat in Lake Tahoe was caused by an epizootic carried by lake trout.

LAUER, C. 1983. Lakes Muskoka, Rosseau and Joseph: A review of past data collection programs and requirements for the future. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario.

This report provides a review of past data collection programs and requirements for the future. All three lakes have been extensively stocked since 1901 with a variety of species including lake trout, rainbow trout, walleye and smallmouth bass. Lake Joseph was last stocked in 1975 with rainbow trout and has not been stocked with lake trout since 1967. Lakes Muskoka and Rosseau continue to receive regular plantings of lake trout and Lake Muskoka receives rainbow trout as well. Smelt have been introduced accidentally to all three lakes and are fed upon heavily by lake trout.

The lake trout harvest is comprised of 98% native fish in Lake Joseph, 51% in Lake Rosseau and 11% in Lake Muskoka. Lake Joseph is, by far, the most heavily fished of the three lakes and produces the greatest annual harvest. This harvest is comprised almost entirely of native lake trout and does not rely on stocking. On Lake Muskoka, the most serious problem appears to be the failure of natural lake trout recruitment. The present harvest on Lake Rosseau is close to the maximum sustainable yield. Approximately 50% of the lake trout harvest is made up of hatchery-reared fish.

LAWRENCE, J. D. 1907. Report on the state hatcheries for the year 1906. p. 359-370. *In* The 12th Annual Report of the Forest, Fish and Game Commissioner of the State of New York. Albany, New York.

The distribution of fish during the year just closed has been far greater than ever before. From the United State Commission we received a total of 4,250,000 lake trout eggs. The eggs were hatched and most of the resulting fry were distributed in the Great Lakes but 2,124,000 lake trout fry were secured by individual citizens from the United States Commission through their representatives in Congress. These fish were distributed in various lakes of the state.

LEARY, R. F., F. W. ALLENDORF and G. K. SAGE. 1995. Hybridization and introgression between introduced and native fish. p. 91-101. *In* H. L. Schramm, Jr. and R. G. Piper [eds.]. Uses and Effects of Cultured Fishes in Aquatic Ecosystems. American Fisheries Society Symposium No. 15. Bethesda, Maryland.

The ability of stocked fish to mitigate loss of natural reproduction effectively is again being questioned. A major concern is that the introduced fish may hybridize with native populations and disrupt local adaptations. Numerous examples of interspecific hybridization and introgression exist. Hybridization between introduced fish and conspecific native populations is not as well documented but likely reflects difficulty of detection rather than limited occurrence. Hybridization often adversely affects a number of attributes important to fitness (e.g., survival, growth, reproductive success and development). These potential adverse effects of hybridization between introduced and native fish can best be minimized by reducing the role of introductions in mitigation programs. Initial emphasis should be placed on treating causes, such as degraded habitat, not on the symptom, reduced reproduction. If introductions are necessary, then a knowledge of the population genetic structure of the taxon, at least in the supplemented area, is essential to minimize potential genetic changes in native populations. Once a hybrid swarm has been formed, it is unlikely that natural processes will cause the swarm to revert back to a genetically pure population of the native taxon. This reversion can be accomplished by eradication of the hybrid swarm and re-introduction of the native taxon. This process is likely to be effective in only a small number of circumstances. When eradication is not feasible, genetic restoration can be attempted by introducing native fish into the hybrid swarm. If the native fish successfully reproduce they will reduce the proportion of foreign genes in the population.

LEMKE, E. 1975. Lake trout and brook trout winter fishing in the Brockville district, 1973-74. File Report. Ontario Ministry of Natural Resources. Brockville, Ontario.

A winter creel census was conducted on selected lake trout and brook trout lakes in the Brockville district. Lake trout season this year opened on March 9. Between March 9 and April 7, 111 lake trout were sampled on Big Rideau Lake. Eighty-two of these fish (73.8%) were stocked fish. A total of 440 lake trout were sampled on Charleston Lake during the same period. Two hundred and fifty-three trout (57.5%) were stocked fish. None of the 19,250 yearling lake trout, stocked in 1968 and marked with an adipose fin clip, showed up in the creel census.

LIIMATAINEN, V. A. 1983. Hatchery stocking in the rehabilitation of low pH lake trout lakes. File Report. Ontario Ministry of Natural Resources. Sudbury, Ontario. 30 p. + appendices.

In the past, the Sudbury area has lost lake trout populations from about 60 lakes. Acidification of waters appears to be the principle reason. Destructive logging practices along with overfishing also played a part in the losses of these populations. In the spring of 1981, as part of a regional stocking assessment program, four lakes (Bowland, Roland, Pedro and Iron) were stocked with yearling lake trout in order to assess their potential for rehabilitation. The lake trout stocked were Lake Manitou stock, hatched at the Sandfield hatchery, reared at the North Bay hatchery and stocked at a rate of 12 per hectare of lake surface area.

Since the initial stocking netting assessments have been carried out on the lakes in the summers of 1981 and 1982. Assessment gear was gill net comprised of random mesh sizes ranging from 2.54 cm to 6.35 cm. During the 1981 and 1982 netting assessments, stocked lake trout were recovered in all the lakes although returns were very low in Bowland.

Survival of young stocked lake trout was poor in waters having a pH less than 5.0 and we recommend that stocking lakes with pH levels < 5.0 not be considered. Mercury analysis of stocked lake trout did not reveal any increase in mercury concentration with decrease in lake water pH. The success of stocking appears to be related to the fish communities present in the lakes. Our data indicate that stocking barren lakes would likely result in the best success. Lakes similar to Iron Lake with established lake trout populations seem to be holding their own and would not appear to warrant stocking. We believe that hatchery introductions could certainly be used in the restoration of fish stocks in some Sudbury area lakes.

LIIMATAINEN, V. A., E. J. SNUCINS and J. M. GUNN. 1987. Observations of lake trout (*Salvelinus namaycush*) spawning behaviour in low pH lakes near Sudbury, Ontario. Ontario Fisheries Acidification Report Series No. 87-10. Ontario Ministry of Natural Resources. Toronto, Ontario. 71 p.

The spawning behaviour of lake trout (*Salvelinus namaycush*) was assessed in 5 low pH (pH 5.1-5.7) lakes in the Sudbury area and in one circumneutral reference lake. The lake trout in the low pH lakes exhibited recruitment failure with no evidence of successful reproduction for, in some cases, a decade or more. The numbers of native lake trout in the low pH lakes were estimated to be in the range from 2 to 22. The remnant adult populations continued to spawn and produce viable gametes. Selected spawning sites were shallow (6 cm-3 m depth) and usually near shore, making them vulnerable to acidic run-off. Some sites were located well offshore (~75 m) with little potential of exposure to run-off water.

Extensive use was made of ultrasonic transmitter tags to locate spawning sites and to provide information about the movements of adults during the spawning period. Additional findings included: egg predation by juvenile hatchery-stocked lake trout, unusual inverted swimming displays by spawning adults, and spawning of mature hatchery-stocked lake trout with native adults.

LITTKEMANN, P. 1960. Biological report on Steenburg Lake, Hastings County. File Report. Ontario Ministry of Natural Resources. Bancroft, Ontario.

The lake trout was a native fish in Steenburg Lake and once frequently taken by anglers and annually observed on their favourite spawning grounds. This species has progressively declined to a stage where it was not present in gill netting which was done in the summer of 1960. In the past 38 years, a total of 167,450 lake trout were stocked in 19 different plantings. Since the spawning grounds in Steenburg Lake are considered to be in good condition, the decrease or perhaps disappearance of this species remains unsolved.

LIVINGSTONE, B. 1990. 1990 assessment of Birch and Snapshot lakes. File Report. Ontario Ministry of Natural Resources. Blind River, Ontario.

Four gill net sets in Snapshot Lake produced only three lake trout; two small fish (26.0 and 28.5 cm) stocked in 1988 and one fish (68.1 cm) stocked in 1981. Both herring and whitefish were plentiful. The low number of fish caught as compared to the other lake trout lakes assessed could be from a combination of angling pressure and competition.

In Birch Lake, six lake trout were caught in four net sets. Only one fish was clipped, having been stocked in 1989. The other five fish were large, ranging in weight from 3.8 kg to 6.4 kg.

LOFTUS, D. H. 1982. 1981 winter creel census on Dickey, Drag, Koshlong and Twelvemile lakes. File Report. Haliburton-Hastings Fisheries Assessment Unit Report. Ontario Ministry of Natural Resources. Bancroft, Ontario. 23 p.

Creel censuses were conducted on these four lakes during the winter of 1981 to measure angling effort and success and to characterize target populations. The survey extended from January 1 until ice-out which occurred on or about April 2 in 1981.

Dickey Lake is a small (214 ha) lake trout-bass lake. Lake trout have been stocked since the 1920s. Winter fishing success for lake trout was reasonably good with a catch-per-unit-effort (CUE) of 0.15 fish per hour. Sixty-eight percent of the lake trout examined had been clipped. Regeneration of clipped fins seemed negligible and fin clip observations are therefore considered to be reliable. Dickey Lake lake trout rarely weighed more than 1.0 kg. An examination of stomach contents indicated that they were almost exclusively planktivorous during the summer months. Larger food items, including underyearling smallmouth bass, were more frequent in the winter months although zooplankton and small benthic organisms were predominant.

Drag Lake (1008 ha) is a lake trout-lake whitefish-bass lake. It has also been stocked with lake trout since the 1920s. The winter lake trout harvest was estimated to be 600±188 fish. Nine percent of the lake trout examined had been clipped. Fin clip records are considered accurate because of the small size of the fish seen. Of 112 trout stomachs examined, they contained underyearling smallmouth bass, minnows, mayfly nymphs, caddisfly larvae and amphipods.

Koshlong Lake (401 ha) is a lake trout-smallmouth bass lake. Lake trout have been stocked since the 1950s. The winter harvest of lake trout was estimated to be 322±194 fish. Sixty-seven of the seventy-seven trout examined (87.0%) appeared to be unclipped. Of the remainder there was a single specimen with a left ventral clip and nine others with adipose fin clips. It is strongly suspected that many more of the fish had been clipped and that fin regeneration occurs quickly, necessitating more careful scrutiny of fins.

Twelvemile Lake (476 ha) is a lake trout-lake whitefish-bass lake. Lake trout have been stocked in the lake for many years. Rainbow smelt are well established. The total winter harvest amounted to 121±54 lake trout. Fin clips were noted on 8 of the 34 trout examined (23.5%) This number is considered inaccurate because of the likelihood of fin regeneration in this fast growing population.

LOFTUS, D. H. 1985. Lake trout fisheries in the Haliburton-Hastings area. *In* 1985 Lake Trout Seminar: North Central Region, February 13-14, 1985, Thunder Bay, Ontario.

A summary of the history of the lake trout fishery in the Haliburton-Hastings area is presented. Access, exploitation, and introductions are discussed.

Exploitation began in the late 1800s and jacklighting and spearing of lake trout took place until at least the 1930s. There was probably a great increase in fishing effort on all lakes during the 1960s as a result of cottage development, the widespread use of the snowmobile, and the reopening of lakes to winter fishing after at least ten years of winter closure. Lake trout is now heavily exploited. Summer fisheries tend to be dominated by cottagers; winter fisheries by area locals.

Stocking of most lakes began in the 1920s and the 1930s. At first, eggs were planted, but fall fingerlings were planted in the 1940s and by the 1950s, virtually all trout were planted as yearlings. Stocking of trout continues, although it remains to be fully rationalized. Returns seem to be best in lakes in which native stocks are absent or severely depressed. Stocking may actually lead inadvertently to increased pressure on native lake trout stocks. The regeneration of clipped fins on stocked fish may be a problem resulting in overestimation of yields of native trout. During the 1940s lake herring were planted as a forage fish for the lake trout and now in those areas the trout have the potential to become quite large.

LOFTUS, D. H. and S. R. RUBIE. 1982. The 1981 Koshlong Lake creel census. File Report. Haliburton-Hastings Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Bancroft, Ontario. 15 p.

Koshlong Lake, Glamorgan Township, is a lake trout-smallmouth bass lake supporting active fisheries for both species. Lake trout were introduced to Koshlong Lake in 1956 and maintenance stocking has continued to the present time. There is presently no firm evidence that significant natural recruitment of lake trout occurs.
In 1981 the Haliburton-Hastings Fisheries Assessment Unit conducted creel censuses on the lake from January 1 to March 31 and from June 1 to October 9. In the winter fishery, it was concluded that the lake trout catch consisted almost entirely of 4 year old and 6 year old fish, or fish originating from the 1975 and 1977 year classes. Lake trout were last stocked in Koshlong Lake in 1976 and 1978. Those stocked in 1976 were unclipped while those stocked in 1978 were given adipose fin clips. Fourteen of the 24 fish (62.5%) aged as four year olds had adipose clips suggesting that some of the fish in the 1975 year class were the result of natural recruitment.

In the summer fishery, none of the 22 lake trout seen showed evidence of fin clips. Fish, mainly smelt, occurred in 71% of the lake trout stomachs. Young smallmouth bass were present in at least 5% of the stomachs examined.

Winter caught lake trout tended to be much smaller than summer caught lake trout. This is probably due to the fact that the winter angler is the first to crop off each new year class as it becomes vulnerable to angling.

There is presently no conclusive evidence that there is significant natural lake trout recruitment in Koshlong Lake. Natural recruitment is suggested by the absence of the fin clips on some of the 4 year old fish. Aging methods are currently being refined and it is expected that data on 4 year old and 5 year old fish in the 1982 winter fishery will help to resolve questions concerning recruitment.

MACHNIAK, K. 1975. The effects of hydroelectric development on the biology of northern fishes (reproduction and population dynamics) IV. Lake trout (*Salvelinus namaycush*). A literature review and bibliography. Fisheries and Marine Services Division Technical Report 530. 52 p.

The lake trout, a native of the glacial lakes region, has been widely introduced into lakes and reservoirs where they did not occur originally. Many introductions have resulted in successful commercial or sport fisheries which occasionally require maintenance plantings where the productive potential is poor, the lake fertility low or angling intense.

Beginning in 1959, over 100 lakes in Sweden have now been stocked with lake trout. As expected, the introduced fish fed readily on small-sized species of fish like whitefish, cisco and smelt. They also fed on crustaceans like *Mysis relicta* and *Pallasea quadrispinosa*, especially in the early years of life. The growth rate has appeared to be very variable but is on the whole encouraging. One favourable characteristic of the lake trout is its long lifespan; this permits it to grow for very long periods which means that fishing on one stocked lot can continue for many years. The survival and reward of recapture of stocked lake trout as well as other species has been evaluated by means of tagging the fish. It seems that generally a size of 20 cm or more gives the best reward. Survival has been low for fish released as young-of-the-year but very good in fish released as two year olds. Yearlings have given intermediate results. Recapture figures amounting to 200 kg per 1,000 released fingerlings are rewarding enough to satisfy stocking lake trout in Swedish reservoirs.

MacDONALD, C. and R. T. HARTLEY. 1988. 1988 juvenile lake trout stocking assessment. File Report. Leslie M. Frost Natural Resources Centre. Ontario Ministry of Natural Resources. Dorset, Ontario. 11 p.

Lake trout population assessments were conducted on eight Frost Centre lake trout lakes to obtain information regarding stocking success of hatchery reared lake trout as compared to natural recruitment. The results from this study have been used to assist in updating stocking requirements and determine survival of recently planted lake trout (juvenile lake trout). This information obtained from this study is a requirement of the Frost Centre Fisheries Management Plan. The study lakes include: Red Pine, St. Nora, Upper Kushog, Raven, Big Hawk and Little Hawk. Both Clear and Sherborne lakes were excluded from the project since they are currently monitored by the Acid Study Group (ASG) in Dorset.

In Upper Kushog Lake 77% of the trout caught were of hatchery origin, while 86% of the total catch was of hatchery origin in St. Nora Lake. Red Pine demonstrated good natural recruitment and stocking in this lake is no longer necessary. Both natural and stocked lake trout were captured in equal amounts on Margaret Lake during this study while Raven Lake showed poor natural recruitment. Nunikani Lake demonstrated good natural recruitment although 58% of those trout recorded from the winter creel were of stocked origin. Little Hawk Lake currently has a stabilized natural population that has benefited from the large percentage of stocked fish caught by anglers. In Big Hawk Lake natural and stocked lake trout were captured in equal amounts although there is evidence that the natural population may be declining.

Recommendations include:

- Lake trout assessment should be conducted as early in the spring as possible to decrease the amount of stress placed on captured lake trout.
- A population assessment conducted on Kushog Lake would be more accurate and complete if both the Northern and Southern arms were taken into consideration.
- Stocking should be discontinued on Red Pine and Nunikani lakes.
- Gangs of nets using only 1" and 1.5" mesh sizes would be more suitable for catching juvenile lake trout.

MacLEAN, J. A., D. O. EVANS, N. V. MARTIN and R. L. DESJARDINE. 1981. Survival, growth, spawning distribution and movements of introduced and native lake trout (*Salvelinus namaycush*) in two inland Ontario lakes. Canadian Journal of Fisheries and Aquatic Sciences 38 : 1685-1700.

This paper attempts to develop a biological basis for the management of stocks of lake trout (*Salvelinus namaycush*). Recent studies of the influence of genetic differences on the survival of planted stocks of trout and the spatial distribution and movements of lake trout populations are reported. The genetic origin of planted lake trout influenced their survival in four Ontario Lakes, whereas water hardness of the rearing hatchery had little effect. Survival also appeared to be influenced by the status of the native population but growth rates of native and introduced trout were similar. Age of first maturity appeared to differ between stocks in Lake Simcoe. Studies with both numbered and sonic tags in Lake Opeongo suggested that lake trout do not home to their natal shoal. Differences in total distances traveled were observed between the sexes, but both males and females moved between shoals at spawning time. In Lake Simcoe, planted trout dispersed widely, colonizing spawning shoals up to 30 km from release sites, and no differences between stocks in time of spawning could be detected despite apparent differences in the home lakes. Temperature influenced spawning time and accounted for most of the timing variation between two allopatric lake trout stocks.

MacLEAN, N. G. and G. W. HOOPER. 1981. Rideau Lakes background report. Report No. 1. Rideau Lakes Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Sharbot Lake, Ontario. 111 p.

This report summarizes background information for the nine lakes designated for long term monitoring by the Rideau Lakes Fisheries Assessment Unit. Five of these lakes support lake trout fisheries which have been supplemented over the years by stocking.

Big Clear Lake was first planted with lake trout in 1934. Between 1934 and 1980, a total of 15,034 fingerlings and 30,600 yearlings were stocked.

Big Rideau Lake was first stocked with lake trout (380,000 fry) in 1890. Between 1890 and 1980, a total of 3,153,000 fry, 28,875 fingerlings and 283,798 yearlings have been stocked.

Big Salmon Lake was first stocked with lake trout in 1952. Between 1952 and 1980 a total of 27,550 yearling lake trout have been stocked.

The first record of lake trout stocking in Charleston Lake was 1888. Between 1888 and 1980 a total of 2,765,500 fry, 175,000 fingerlings, 332,850 yearlings and 200 two year old lake trout were stocked.

Devil Lake was first stocked with lake trout in 1924. Between 1924 and 1980, a total of 140,000 fry, and 88,000 yearling lake trout were stocked.

MAINE DEPARTMENT OF INLAND FISHERIES AND WILDLIFE. 2000. Guidelines to fish stocking in Maine. Fisheries Research Division. Bangor, Maine. 5 p.

Lake trout are stocked in deep coldwater lakes and ponds where summer temperatures in the deepest water are less than 60° F and where dissolved oxygen concentrations in the deepest water exceed 5 parts per million. Adequate populations of suitable forage fish species must be present to assure growth of the stocked fish. Lake trout are stocked to provide fishing in waters where natural reproduction is not successful or where natural reproduction does not maintain populations large enough to support satisfactory fisheries. They may also be introduced to waters with suitable habitat to create new fisheries. As lake trout usually spawn in shallow water on rocky shoals or shoreline, an abundance of this type of habitat in a body of water will improve the prospects of establishing a population that can be sustained through natural reproduction.

Lake trout are stocked as spring yearlings at an average size of 6 to 8 inches. The amount of habitat available during the summer and the productivity of the water are important factors to consider in stocking lake trout. Water at depths less than 40 feet is usually too warm to support lake trout during the summer. Water deeper than 100 feet is generally not very productive even though lake trout live there. Therefore, the area less than 40 feet deep and greater than 100 feet deep are discounted from the total area of a body of water considered for lake trout stocking.

Other factors affect the growth and survival of lake trout stocked in any body of water including the size of the fish at stocking, the type and abundance of forage available, the presence of other coldwater gamefish (especially salmon) and the presence of potential predators. These will influence the stocking rate on a water-by-water basis. Follow-up surveys of the fish populations and sport fisheries in each water stocked with lake trout will determine the success of the stocking program and may lead to refinements in the recommended stocking rate. Up to 5 spring yearlings may be stocked per surface acre of water with depths between 40 and 100 feet.

Waters are usually stocked on an annual basis. Follow-up surveys may justify less frequent stocking on individual waters. Prior to stocking most lake trout are marked with a fin clip to aid in future identification. Stocking occurs as soon as possible after ice-out, while the surface water is still cold. In lakes and ponds where predation may threaten survival immediately after stocking, lake trout are boated away from shore and scatter-planted over deep water.

Lake trout studies may be undertaken involving stocking rates or methods that differ from those outlined in this policy; studies are set up on a timetable and their results are evaluated at the end of a specified time period.

MANTLE, E. F. 1967. Assessment of natural reproduction, Lake Superior lake trout, Sunny Lake, Dunmore Township. File Report. Ontario Department of Lands and Forests. Sault Ste. Marie, Ontario. 2 p.

Between October 1963 and January 1966, attempts were made to determine whether or not natural reproduction of the introduced population of Lake Superior lake trout was taking place in Sunny Lake. It was determined that these fish are going through the mechanics of spawning but attempts to determine egg and/or fry survival remain inconclusive.

MARNELL, L. F. 1986. Impacts of hatchery stocks on wild fish populations. p. 339-347 *In* [ed.]. R. H. Stroud. Fish Culture in Fisheries Management. American Fisheries Society. Bethesda, Maryland.

This paper deals exclusively with impacts of hatchery-reared game fishes upon wild fish populations. Salmonids are emphasized because they are the dominant hatchery products.

Impacts of hatchery-reared sport fish on wild fish populations may be summarized as follows:

- Introduction of pathogens and parasites.
- Hybridization, introgression and intergradation.
- Trophic alteration through predation, cannibalism and competition for food.
- Spatial alterations (e.g., territorial shifts, altered dominance hierarchies, stress, aggression and altered movements)
- Altered growth and survival characteristics.
- Displacement, replacement and extinction.

MARSHALL, T. L. and R. P. JOHNSON. 1971. Lake trout. p. 10. *In* History and Results of Fish Introductions in Saskatchewan 1900-1969. Fisheries Report No. 8: Fisheries and Wildlife Branch, Department of Natural Resources. Saskatoon, Saskatchewan.

Early attempts to extend the range of lake trout southward in Saskatchewan began in 1926 through 1929, 1933 and 1940. In that period six of the fourteen lakes stocked to date received lake trout fry originating in Port Arthur, Ontario. None of these six proved capable of supporting the species. None exceeded a maximum depth of 33 m or a mean depth of 9.6 m; failure is attributed to temporary depletion of well oxygenated cool summer waters. Saskatchewan lakes south of the Shield which support natural populations of lake trout have mean depths of 13 m or more with a minimum 2% of the lake volume below a depth of 30 m. Upper temperatures < 10° C and dissolved oxygen ≥ 3 cc/l seem requisite for lake trout survival.

Despite the collection of lake trout eggs from Lac La Ronge beginning in 1948 for trade with the State of Montana, distribution of fry and fingerlings in Saskatchewan did not resume until 1960. The eight lakes stocked since characteristically have deep, cool freshwater; some have been reclaimed while others have limited populations of predators. Most of these waters have had time to demonstrate their ability to sustain a limited lake trout fishery.

The most successful population is in Whelan Bay. The clean rocky spawning areas found here are a major factor in natural reproduction. Features include a landlocked basin, surface area of 1,904 ha, maximum depth of 41 m, mean depth of 18.6 m and a native fish fauna restricted to limited numbers of pike, cyprinids and white sucker.

MARTIN, N. V. 1953. The creel census and fish management in Algonquin Park. Ontario Department of Lands and Forests. Maple, Ontario.

Lake trout have been regularly planted in those heavily fished lakes adjacent to Highway 60. Smoke, Opeongo, Source, Cache, Two Rivers, Rock and Whitefish lakes have each received two to ten thousand lake trout in every other year since 1948. It is too early yet to determine whether these plantings have been successful as it takes about five or six years for the lake trout to reach catchable size.

MARTIN, N. V. 1966. The significance of food habits in the biology, exploitation, and management of Algonquin Park, Ontario, lake trout. Transactions of the American Fisheries Society 95(4) : 415-422.

Algonquin Park lake trout may be piscivorous or planktivorous dependent on available food supply in the summer months. Plankton-feeding lake trout grow more slowly, do not reach as great a size or age as fish-feeders, and mature at a smaller size and younger age. Trout transferred from a plankton-feeding to a fish-feeding population grow at a faster rate and extend their life span.

Fisheries in planktonivorous populations return larger numbers of smaller and younger fish to the angler. A higher percentage of mature fish occurs in these fisheries. The catch is dependent on fewer year classes and year-class strength is more variable. Yields in numbers per acre is higher in plankton-feeding populations but is comparable with fish-feeding populations in terms of pounds per acre.

The implications of these findings is such management practices as size limits and quotas, lake closures, and forage fish introductions are discussed.

MARTIN, N. V. and F. E. J. FRY. 1972. Lake Opeongo: Effects of exploitation, and introductions on the salmonid community. Journal of the Fisheries Research Board of Canada 29 : 795-805.

Lake Opeongo, a 58.6 km^2 lake in the highlands of Algonquin Park, Ontario, has been under study since 1936. Due to little human development of the area, environmental conditions have been stable but because of its geological setting and location the lake waters are relatively unproductive.

The smallmouth bass introduced in 1928 has had no apparent major impact on the salmonid community but has served to buffer fishing pressure on the lake trout. The cisco introduction in 1948 resulted in faster growing, better conditioned, and more fecund lake trout but has also contributed to their later maturity. Weight production of trout increased and in recent years stronger classes have apparently resulted from the improvement in fecundity. Declines in the perch and benthic insects and a decrease in growth rate of certain fishes since the mid-1950s are apparently related to the cisco introduction.

Large numbers of brook trout (*Salvelinus fontinalis*), lake trout (*S. namaycush*) and hybrid trout (*Salvelinus fontinalis* x *S. namaycush*) from a wide variety of sources have been planted in Opeongo over a period of at least 35 years. Harvest of lake trout by the sport fishery has varied from 630 to 2700 fish/year representing a long term yield of 0.33 kg/ha. Mean total mortality rate is 50%/year and exploitation has served to double the mortality rate after the trout have entered the fishery. Year-class production is correlated with spawning escapement and exploitation has limited recruitment to the trout population.

MARTIN, N. V. and C. H. OLVER. 1976. The distribution and characteristics of Ontario lake trout lakes. Research Report No. 97. Ontario Ministry of Natural Resources, Fish and Wildlife Research Branch. Toronto, Ontario. 30 p.

A total of 2,000 known inland lake trout lakes occur in the Province of Ontario. The lake trout is known to have been introduced into at least 195 Ontario lakes. This may require some future adjustment as the origin of some populations is still uncertain. Although many introductions have been made in waters within the natural range of the lake trout, extensive planting has occurred well outside the original range of the species. In northeastern Ontario, stocking has extended the range of the lake trout well into the Hudson Bay drainage on the Moose and Albany River systems. Very few introduced populations are found in the northcentral and northwestern regions of the Province.

MATZ, T. 1971. 1971 Lake Manitou winter creel census. Ministry of Natural Resources, File Report. Ontario Ministry of Natural Resources. Espanola, Ontario.

The 1971 winter creel census of Lake Manitou indicates that the past winter's ice fishing was supported primarily by hatchery-raised fish. It is significant to note that the angler success per rod-hour dropped to almost half its 1970 level, i.e. from 0.24 trout per rod-hour to 0.13 trout per rod-hour.

In the 1970 fishery, 75.2% of the fish were native stock, with hatchery fish making up only 24.8% of the total catch. However, during the 1971 fishery, the percentage of hatchery fish more than doubled to 51.3% of the total catch, with native stock making up only 48.3% of the total catch.

McAFEE, W. R. 1966. Lake trout. p. 260-268. *In* A. Calhoun [ed.]. Inland Fisheries Management. California Department of Fish and Game. Sacramento, California.

The life history of the lake trout is discussed as pertaining to distribution, habitat, reproduction, growth, behavior and management. Guidelines for stocking lake trout are also given.

Annual stocking of yearlings might be feasible where overfishing of lake trout stocks is a problem. Webster et al. (1959) discuss such a program in Cayuga Lake, New York.

The suitability of lakes for this species can be gauged by the following criteria:

- They must provide an abundant supply of well-oxygenated water 55° F or colder throughout the year.
- They should be deep (Studies of 10 Colorado lakes indicated that those deeper than 50 feet were best).
- Small, heavily fished lakes are unsuitable.
- Areas of clean rock and rubble are needed for most successful spawning. Siltation and water level fluctuations may harm suitable spawning areas in reservoirs. Eggs might by left "high and dry" if water levels are lowered after spawning is completed. Prespawning drawdowns may expose the best spawning beds and force lake trout to spawn in less favorable areas. Artificial spawning areas can be created in lakes or reservoirs where natural ones are lacking.

Lake trout utilized artificial rock and rubble "reefs" in two Algonquin Park lakes in Ontario and in Green Lake, Wisconsin.

- An abundance of forage fish is necessary for optimum lake trout production. They can subsist on invertebrates, but growth rates are slower and maximum sizes smaller.
- Lakes that support good populations of rainbow, golden, or cutthroat trout and negligible numbers of rough fish should not be stocked with lake trout.
- Small lakes with good fisheries maintained by fingerling plants could be hurt by extensive lake trout predation and should not be stocked.

McALLISTER, P. E. and R. L. HERMAN. 1989. Epizootic mortality in hatchery-reared lake trout (*Salvelinus namaycush*) caused by a putative virus possible of the herpesvirus group. Dissertation of the Aquatic Organization 6 : 113-119.

McAUGHEY, S. C. 1994. 1994 spring littoral index gill netting (SLIN) on Whitefish Lake, Humphrey Township. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 5 p.

From April 29 to May 5, 1994, a total of 40 short set littoral index gill nets (SLIN) were set in Whitefish Lake. Four lake trout and 3 common white suckers were caught. The mean catch rate of 0.18 lake trout/45m/hr is well below the provincial average for lakes that have been completed to date. Three of the four trout (75%) were fin clipped. Three nets were subsequently set overnight to capture more lake trout. Eleven trout were captured in the overnight sets.

The movement of trout between Whitefish and Clear lakes is probably considering the lack of barriers between the two lakes. A native lake trout fishery presently exists in Clear Lake which will probably be removed from the stocking list. This may not be effective unless Whitefish Lake is removed from the stocking list as well.

McCRIMMON, H. R. 1956. Plantings of lake trout in Lake Simcoe. p. 55. *In* Fishing in Lake Simcoe. Ontario Department of Lands and Forests. Toronto, Ontario.

The first record of lake trout stocking in Lake Simcoe was in 1880 when 40,000 fry and fingerlings were released. One hundred thousand fry were also released in both 1887 and 1889. The next stocking of lake trout did not occur until 1914 when 100,000 fry were stocked. Fry and fingerlings were stocked on a regular basis until 1943 when the yearling fish (1,860) were stocked for the first time. Between 1880 and 1955 (inclusive) a total of 3,449,500 fry and 38,410 yearling lake trout were stocked in Lake Simcoe.

McCRIMMON, H. R. 1967. The Newcastle fish hatchery, Newcastle, Ontario. File Report. University of Guelph. Guelph, Ontario. 2 p.

In 1868, Samuel Wilmot enticed the Canadian government to provide financial support for the construction of buildings for what may be considered as the first full scale government hatchery in the New World. Although initially built for the culture of Atlantic salmon (*Salmo salar*) other fishes reared included brook trout, lake whitefish, smallmouth bass, muskellunge and yellow pickerel. Lake trout were first reared from Lake Huron eggs in 1869.

McCRIMMON, H. R. and E. SKOBE. 1970. The fisheries of Lake Simcoe. Fish and Wildlife Branch, Ontario Department of Lands and Forests. Toronto, Ontario. 140 p.

The early interest in the lake trout fishery decreed that Lake Simcoe receive its first planting of hatchery lake trout in 1880 when 40,000 fry and fingerlings were sent from the fish hatchery at Newcastle. Several more plantings were made during the next 40 years. Since 1925, annual plantings have been the rule. While fry and fingerling fish have been commonly planted, the policy of planting as may yearling fish as possible was begun in 1943. Lake Simcoe has been stocked with a total of 3,449,500 fry and fingerlings and 38,410 yearling lake trout between 1880 and 1955. Between 1952 and the present several million lake trout eggs were collected from lake Simcoe for hatchery purposes in each October. The distribution of lake trout by aircraft was initiated in 1955 and proved very satisfactory.

McDONALD, D. G. and J. G. ROBINSON. 1993. Physiological responses of lake trout to stress: Effects of water hardness and genotype. Transactions of the American Fisheries Society 122 : 1146-1156.

We evaluated stress due to net confinement among three genetically isolated strains of juvenile lake trout (*Salvelinus namaycush*) in relation to water hardness. Changes in plasma cortisol, glucose, sodium and chloride were used as stress indicators. In lake trout acclimated and then confined for 8 hours in hard water, plasma glucose and cortisol increased significantly (by three- and six-fold, respectively), reaching a plateau by 4 hours while plasma Na^+ and Cl^- significantly decreased by about 7%. Fish transferred from hard water to soft water and then confined exhibited significantly greater changes in blood chemistry than did fish confined in hard water. This soft-water effect on the stress response disappeared if fish were first acclimated to soft water, but full soft-water acclimation may take at least 2 months. Comparisons of blood chemistry among three different strains of lake trout (Lake Manitou, Killala Lake, and Slate Island) revealed significant differences in their responses to confinement stress. These findings have important implications for two fish culture issues: the choice of whether to rear stocks in soft-water versus hard-water hatcheries, and the selection of stocks for stress resistance.

McDONALD, D. G., M. D. GOLDSTEIN and C. MITTON. 1993. Responses of hatchery-reared brook trout, lake trout and splake to transport stress. Transactions of the American Fisheries Society 122(6) : 1127-1138.

The stress of routine transport practices on hatchery-reared brook trout (*Salvelinus fontinalis*), lake trout (*S. namaycush*) and splake (*S. fontinalis* x *S. namaycush*) was evaluated by measuring changes in plasma levels of the stress hormone cortisol, the key stress metabolite glucose, and the plasma electrolytes Na^+ and Cl^-, and by measuring net ion and ammonia exchanges with the water in the transport tanks. We examined actual transport trips and standardized net confinement stress in the laboratory to quantify differences in stress response among the species. Brook trout were the least sensitive to both transport stress and net confinement, and responded in a similar fashion to both treatments. Splake responded to transport like brook trout but were the most sensitive to net confinement. Species differed most in their ability to maintain ion exchanges with the water under stress. Lake trout experienced ion losses during transport that were about ten-fold higher than losses from brook trout and splake. Trip duration (3.5 – 11 h) had only a minor effect on physiological responses, and wide variations in loading density (6.9 – 17 kg/100 L) had no significant effect. Increasing O_2 levels in the water (due to oxygenation rather than aeration of tanks) proved to be moderately stressful to brook trout, based on elevations in plasma cortisol levels. Our results permit an evaluation of the relative contributions of different transport variables to the transport stress imposed on salmonids.

McDONALD, G. and C. WOOD. Undated. Handling stress in lake trout. Report prepared for the Ontario Ministry of Natural Resources. Toronto, Ontario.

The purpose of this project has been to study handling and transport stress in lake trout particularly as it relates to the Ministry of Natural Resources stocking program for hard water and soft water habitats. A net confinement procedure has been used to simulate the stresses of handling and transporting fish. Fish were held in close physical contact in nets in well-aerated and temperature controlled water for up to 8 hours and then released to recover. Levels of stress were assessed on the basis of blood concentrations of the stress hormone cortisol and glucose and the two major plasma electrolytes, Na^+ and Cl^-.

Stress tests revealed significant differences among strains: Killala strain showed the smallest stress response and Slate Island the largest response. Stocking to soft water environments poses an additional challenge for the lake trout since transfer to soft water is a stress in itself and made worse if combined by handling. These results suggest that stocking of lake trout to soft water habitats should be done from soft water fish culture stations (e.g., North Bay, Tarentorus).

Salt elevation was found to reduce stress during transport. However, during the recovery period a blood chemistry disturbance developed typical of the stress response.

McGURRIN, R. 1977. 1977 summer creel census of Charleston, Red Horse, Singleton and Lyndhurst lakes. File Report. Ontario Ministry of Natural Resources. Brockville Ontario. 82 p.

This report completes the 1977 summer creel census for Charleston, Red horse, Singleton and Lyndhurst lakes. Information was collected for this report from June 15, 1977 to August 28, 1977 using Ministry of Natural Resources Creel Form SF 150, and working on a pre-set schedule. The information collected deals with fish harvest, angling success, fishing pressure, stocking programs and other related topics.

On Charleston Lake, the lake trout fishery is the most important species accounting for 4.19 rod-hours per acre of a total fishing pressure of 7.2 rod-hours per acre for all species (344 of 653 anglers (53%) were seeking lake trout). It is estimated in this report that 1,971 lake trout were caught during the three summer months with only 1,488 (75%) being retained. Based on data collected, 68% of the trout caught were hatchery-reared fish, giving a return of 8.3% on the average yearly stocking over the last ten years.

On Redhorse Lake, bass was the most important species accounting for 9.9 rod-hours per surface acre out of a total 13.4 rod-hours per acre for all species. Bass anglers totaled 165 of 255 (73%) creeled anglers. An estimated 38 lake trout were caught giving a return of 0.7% on the trout stocking programs.

McINTOSH, R. and M. ECKERSLEY. 1976$_a$. 1976 lake trout netting program on Lower Raven Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 11 p. + appendices.

A heavy stocking program has been undertaken on Lower Raven Lake commencing in 1949. A total of 14,800 speckled trout and 12,500 lake trout have been planted with 5,000 of the latter species having been introduced since 1961.

A small lake trout population currently exists in Lower Raven lake. Although our netting program produced 12 fish, the 91.1 one hundred foot hour of netting effort require to catch each trout is relatively high indicating that lake trout are not abundant. Considering the stocking of 6,500 lake trout since 1958, the capture of twelve fish is quite low suggesting that lake trout are surviving but are not abundant. Netting results indicate that fish stocked in 1974 (left ventral fin clip) have survived well and there is nothing to suggest that the rest of the large fish that were caught were not stocked fish as plantings in 1958, 1959, 1963 and 1965 were of unclipped fish. If natural reproduction is occurring there is not direct evidence to verify it. In 1963 and 1970, stocked trout were fin clipped but netting failed to take any of these fish indicating that the plantings in these years failed to supplement the population to any extent. Factors which may have influenced the success of lake trout plantings include predation by yellow perch.

Further light stocking (e.g., 1,000 yearling fish every 2-3 years) would probably supply enough fish to maintain this fishery. Stocking on a larger scale would be wasteful because the lake cannot support a large population of trout.

McINTOSH, R. and M. ECKERSLEY. 1976$_b$. 1976 lake trout netting program on Cardwell Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 11 p. + appendices.

The lake trout population in Cardwell Lake has all but disappeared. Despite an extensive stocking program, intensive netting produced just one lake trout. It would appear that there is only a small residual population of lake trout, remnants of past stocking or past natural reproduction. There is no evidence that any of the 13,000 yearlings stocked since 1964 have survived at all. In summary, recent stocking efforts have failed almost totally in establishing and/or maintaining a lake trout population and thus nothing in the way of a trout fishery exists. There is no further justification for trout stocking in Cardwell Lake.

McINTOSH, R. and M. ECKERSLEY. 1976$_c$. 1976 lake trout netting program in Waseosa Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 14 p. + appendices.

Waseosa Lake was first stocked with lake trout in 1951. Both rainbow trout and brook trout have also been stocked in the lake. Lake trout have been stocked on a regular basis since 1963. This assessment was conducted to determine the present status of lake trout in Waseosa Lake and what effect stocking of trout has had on the population.

A total of 754 fish were caught of which 80 were released. A total of seven (7) lake trout were caught. Three of the fish (24", 27.5", 29") had a hatchery clipped left pectoral fin indicating that they were stocked in 1963 as yearlings. Two of the seven fish were dead (1 clipped and 1 not clipped) and sampling showed they were both females with stomach contents consisting of pumpkinseeds in one case and cisco in the other. One interesting fact was that the clipped fish was slate grey in color while the unclipped fish was a deep brown in color. This disparity could indicate that the unclipped fish was naturally produced instead of being an unclipped (stocked) fish.

Further lake trout stocking cannot be justified for two reasons. If all lake trout estimated to have been harvested by cottagers in the last 13 years were stocked fish (a highly unlikely occurrence) then the return on the 14,000 fish planted would be approximately 2%. Secondly, the lake appears to be marginally suited for lake trout in terms of habitat and therefore further stocking would have little effect on increasing this rate of return.

McKEOWN, W. Undated. A history of the Lac des Milles Lacs area. *In* A Compendium of Historical Reports Concerning Lac des Milles Lacs, Ontario (Volume 3). File Report. Quetico-Mille Lacs Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Thunder Bay, Ontario.

Since 1921, several attempts have been made to introduce new species of fish into the waters of Lacs des Milles Lacs. These include smallmouth black bass (1921), walleye (1930) and muskellunge (1938). In 1937 150,000 lake trout fry were planted. All of these plantings proved to be unsuccessful with the exception of walleye.

McKEOWN, W. J. 1970. McConnell Lake area creel census, 1969-1970. File Report. Ontario Department of Lands and Forests. North Bay, Ontario. 14 p.

Results of 51 creel census days during the summer of 1969 and winter of 1970 in the McConnell Lake area show 745 anglers fished a total of 1,965 hours for a catch of 1179 fish. The total catch consisted of 800 brook trout, 108 lake trout, 256 pickerel and 19 smallmouth bass. Of lakes containing hatchery marked fish, 83% of the 1969 summer catch were marked fish while winter angling produced 87% marked fish. Lake trout were not marked until 1967, as a result, it is too early to assess the return of hatchery planted lake trout as these are just beginning to enter the fishery.

It is recommended that this creel census be continued to investigate the contribution of hatchery planted fish in the second year and be intensified to determine the fishing pressure and harvest in order that the costs and benefits of the hatchery supported fishery may be determined. In the interim it is recommended that, due to the heavy pressure exerted in this area both winter and summer, that fish plantings be maintained.

McKEOWN, W. J. 1974. McConnell Lake creel census 1971-1973. File Report. Ontario Ministry of Natural Resources. North Bay, Ontario. 52 p. + appendices.

This paper summarizes creel census information on a number of stocked lakes in the McConnell Lakes area between 1971 and 1973. Four stocked lake trout lakes (Cut, Blue, Spring and McConnell) were included. Information for these four lakes may be summarized as follows:

Lake	% Return from # Stocked	Hours of Recreation for 100 Fish Stocked
Blue	1.7%	53.70
Cut	62.7%	364.00
Spring	3.5%	63.57
McConnell	10.3%	133.00

McKNIGHT, T. C. 1977. Investigations of lake trout and whitefish management in Trout Lake, Vilas County, Wisconsin. Fisheries Management Report 98. Wisconsin Department of Natural Resources. Madison, Wisconsin. 18 p.

Fin-clipped lake trout (*Salvelinus namaycush*) were stocked in Trout Lake over a twenty-year period since 1956. Fish from all but two of sixteen stockings were subsequently recovered in fall gill netting and/or winter census of the sport fishery although percent return was low. An average of 38% of the lake trout captured during fall 1957-1976 gill netting operations were stocked trout; the highest proportion of trout recovered was 64% in the 1968 netting sample. Winter censuses of anglers during 1963-1971 revealed an average of 45% of the legal size lake trout bagged were stocked fish. The highest proportion of stocked trout in the catch was 80%, in 1967. Considering fin regeneration, the possibility of incomplete fin removal, and some stockings prior to 1956 without fin clips, the percentages of stocked fish in the harvest and netting samples are considered minimal. No significant trends in numbers or sizes of whitefish (*Coregonus clupeaformis*) were evident from the fall netting or winter checks of anglers, except in 1976 when the net catch dropped somewhat, but average size increased. No obvious optimum stocking size, age, egg source, numbers or time of year to plant lake trout were indicated by analyses of recoveries from the various stockings.

McLEISH, D. A. 1991. Juvenile lake trout stocking assessment, 1986-1989. File Report. Ontario Ministry of Natural Resources. Minden, Ontario. 14 p.

Boshkung Lake has been stocked with lake trout in alternate years with 4,000 in 1985, 6,500 in 1987 and 5,700 in 1989. Netting assessment on Boshkung Lake, Stanhope Township, resulted in a catch of 15 lake trout and a catch-per-unit-of-effort (CUE) of 0.50 lake trout/net metre hours. All lake trout sampled were wild fish. The netting assessment indicate that Boshkung Lake has good natural recruitment and that stocked fish are not prevalent. The lack of stocked lake trout in the catch indicate that stocking should be discontinued. This recommendation is supported by results from a 1988 winter creel survey which reported that only 10% of the harvest was comprised of stocked fish.

Netting assessment of Johnson Lake, Havelock Township, produced a catch of 2 lake trout resulting in a CUE of 0.07 lake trout/100 net meter hours. One lake trout was a wild fish while the other was a stocked fish. The return of lake trout was relatively poor in Johnson Lake. Despite stocking efforts in 1985 (3,302 fish), 1987 (1,400 fish), 1988 (2,000 fish) and 1989 (400 fish) lake trout are not becoming established. A 1988 winter creel survey reported that 100% of the harvest consisted of stocked trout.

Netting assessment in Little Boshkung Lake, Minden Township, yielded one lake trout and a CUE of 0.03 lake trout/100 net meter hours. The lake trout sampled was a wild fish. Lake trout were last stocked in 1985 (2,000 fish) thus the lack of stocked fish in the catch is not surprising. Stocking should be discontinued in this lake.

Netting assessment of Maple Lake, Stanhope Township, yields a sample of 20 lake trout and a CUE of 0.92 lake trout/100 net meter hours. Stocked fish accounted for 65% of the lake trout sample (N=13) and a CUE of 0.60 lake trout/100 net meter nights. The catch of stocked lake trout indicates that stocking should continue in Maple Lake.

Moore Lake was stocked in alternate years with 2,000 fish in 1985, 2,300 trout in 1987, and 2,000 trout in 1989. The recommended stocking rate for Moore Lake is 2,284 lake trout in alternate years. Netting assessment of Moore Lake yielded a sample of 14 lake trout at a CUE of 0.47 lake trout/100 net meter hours. Stocked fish represented 64.3% (N=9) of the lake trout sample for a CUE of 0.30 lake trout/100 net meter hours. Moore Lake should continue to be stocked with lake trout at the recommended stocking rate for three successive years.

Past stocking initiatives on Oblong Lake, Harburn Township, occurred in alternate years in 1985 (2,000 trout), 1987 (2,300 fish) and 1989 (2,000 fish). The recommended stocking rate is 1,138 trout in alternate years. Netting assessment of Oblong Lake yielded three lake trout at a CUE of 0.10 lake trout/100 net meter nights. Netting assessment indicate that stocked lake trout are not surviving very well. Oblong Lake should continue to be stocked at the recommended rate for two more years then reassessed in 1994.

No lake trout were caught in Picard Lake, Cavendish Township, despite forty net sets of effort. The netting assessment indicate that the stocked lake trout are not surviving in Picard Lake despite recent plants in 1986 (1,000 fish), 1987 (1,000 fish), 1988 (900 fish), 1989 (800 fish) and 1990 (900 fish). Anecdotal evidence indicates very poor angling. The lack of lake trout may be attributed to the overabundance of lake herring or the poor habitat. The stocking and management of lake trout should be discontinued in Picard Lake.

Soyers Lake, Minden Township, has been stocked alternative years: 1985 (3,500 fish), 1987 (2,000 fish), 1989 (1,500 fish). Netting assessment of Soyers Lake yielded 14 lake trout and a CUE of 0.47 lake trout/100 net meter hours. Stocked trout represented 28% (N=4) of the lake trout sample and a CUE of 0.13 stocked lake trout/100 net meter hours. Stocked fish were representatives from the 1982 and 1987 stocking. Netting assessment has indicated that there is a good natural lake trout population in Soyers Lake. Natural lake trout comprised 72% of the sample and exhibited a range of age classes. Due to the good representation of natural recruitment, stocking should be discontinued.

McMURTRY, M. J. 1989. Fall trapnetting on the spawning grounds of lake trout and lake whitefish in Lake Simcoe, 1985-1988. Report 1989-3. Lake Simcoe Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Sutton, Ontario. 58 p.

Trapnetting of spawning lake trout and lake whitefish has for several decades played an important role in the assessment and management of these species in Lake Simcoe. The objectives of the fall trapnetting program are: (1) to monitor the status of coldwater fish populations in Lake Simcoe, and (2) to collect lake trout and lake whitefish eggs for subsequent reintroduction to the lake. This report summarizes data collected during 1985-1988 and describes trends over a longer period.

Three trapnet sites – North Georgina, Strawberry Island and Willow Rocks – were netted each year during 1985-1988. The timing of spawning activity at these sites has been consistent over the last decade. Lake trout move onto the shoals at about the second week in October and depart two weeks later. Lake whitefish abundance on the spawning shoals increases in mid November and falls again in early December.

The overall catch of lake trout increased gradually from 1978 until 1987. This can be attributed to the number of fish planted as there is no evidence of survival from egg stage to yearling stage in the lake. The catch of lake trout declined sharply in 1988, possibly due to unusually high windy conditions which reduced net efficiency. The catch of lake whitefish has declined steadily since 1979.

The proportion of stocked fish in the catch has increased from 89% to 99% in 1988 for lake trout, and from 0.1% in 1985 to 8.2% in 1988 for whitefish. The catch of whitefish and the proportion of stocked whitefish in the catch are expected to increase substantially as fish from the 1986-1988 stockings reach reproductive age. There are several signs that recruitment of native whitefish continues to be negligible in Lake Simcoe: the decline in abundance of adults, the low numbers of fish less than 9 years of age in the spawning population, and an increase in the modal length of spawning fish.

Lake trout of Lake Simcoe origin planted in 1978, 1980 and 1982 have had the highest rate of return of stocked trout so far recovered. Few trout of other origins were recovered from 1985-1988. Growth of lake trout from different plantings has been comparable. Of stocked whitefish recovered, those from the 1982 planting showed the highest survival.

McMURTRY, M. J. Undated. Sudbury basin comparative lakes study. File Report. Ontario Ministry of Natural Resources. Toronto, Ontario. 13 p. + appendices.

This reports analyzes stocking assessment information collected from four lakes (Whitepine, Whitefish, Beaver and McCulloch) in the Sudbury basin. Conclusions drawn from this information may be summarized as follows:

- No differences in survival of stocked lake trout in low alkalinity and moderate alkalinity lakes were observed.
- Survival of stocked lake trout appears to be inversely related to the standing crop of resident fish species. Specifically, resident fish species may be competing with and possibly preying on stocked lake trout.
- Season of stocking (i.e., spring vs. fall) had no significant effect on survival of stocked lake trout in either low or moderate alkalinity lakes.
- Size at stocking of lake trout of the same age had no effect on survival or growth in low or moderate alkalinity lakes.

MEDINA, M. S. 1993. Behaviour of hatchery-reared lake trout (*Salvelinus namaycush*) stocked in a thermally stratified lake. B. Sc. Thesis, Laurentian University. Sudbury, Ontario. 35 p.

Using surgically implanted temperature sensitive ultrasonic transmitter tags over a five month period (May to September 1992), the body temperatures of four juvenile hatchery reared lake trout (*Salvelinus namaycush*) were monitored. Body temperatures ranged from 3.0° C to 14.0° C (mean 8.4° C). There were diurnal but not seasonal differences in thermal habitat. Depth distributions were shallower (mean 9.4 m) in spring than during subsequent months (mean 13.0 m). There were individual differences in temperatures and depths occupied. Two fish exhibited a deeper daytime depth distribution than the others. The differences in behavior between individual fish decreased during the course of the study. Displacement rates averaged 2.37 m/min (range 0-26.2 m/min).

MEEHAM, W. E. 1897. The mountain lakes of the state. p. 145-294 *In* Pennsylvania Fish Commission Board: Report No. 18 of the State Commissioners of Fisheries for the Year 1896.

The Pennsylvania Fish Commission has been engaged in restocking our lakes and other waters with food fishes for upwards of twenty years. Next to black bass, the Pennsylvania Fish Commissioners have perhaps gone to more trouble in planting lake trout and pike-perch in our mountain lakes. The quantity of fry deposited during the past five years has been incredibly large and it must be said that apparently, with very few exceptions, there have not been encouraging results.

MICHIGAN DEPARTMENT OF NATURAL RESOURCES. 1987. Fish stocking guidelines. Fisheries Management Report No. 11. Ann Arbor, Michigan. 32 p.

Lake trout should be stocked in large, oligotrophic lakes. Many of these lakes traditionally have been managed for lake trout and some have self-sustaining lake trout populations. Where feasible, natural reproduction is to be sought in these waters. Lake trout should be stocked as 5-7 inch yearlings at rates ranging from 2-25 fish per acre. The expected survival rate to the angler is 20% and the anticipated yield is 1-5 lb/acre.

MILLER, L. M. and A. R. KAPUSCINSKI. In press. Genetic guidelines for hatchery supplementation programs. *In* E. Hallerman [ed.]. Population Genetics: Principles and Practices for Fisheries Scientists. American Fisheries Society. Bethesda, Maryland.

Stocking of hatchery-reared fish is an important component of fisheries management programs. Ecologist and population geneticists, however, have raised concerns about the possible effects of such programs on native fish populations leading to great debate over the appropriate role of hatcheries in modern fisheries management. Hatcheries are increasingly called upon to perform a new role, to rehabilitate depressed natural populations. This new role is often called supplementation. Fisheries managers should be aware of hatchery-related genetic hazards that are responsible for loss or alteration of genetic variation in populations. Without proper adherence to genetic, evolutionary and ecological principles, intended integration of hatchery and naturally reproducing fish may lead to a number of adverse consequences for naturally reproducing fish, eventually damaging restoration efforts and jeopardizing sustainable use of the resources over the long term.

The following genetic guidelines are recommended for the various components of hatchery production from collecting broodstock, spawning adults, rearing offspring and releasing offspring into the wild:

- Collect an appropriate number of fish to minimize genetic differences between the hatchery and wild spawning subpopulations and ultimately to minimize genetic alterations of the overall population.
- Collect less than 50% of the wild spawners if minimum size requirements can be met easily.

- Generally exclude hatchery returns from broodstock collections but re-evaluate this practice and the entire supplementation program if hatchery returns exhibit low fitness on spawning grounds.
- Collect adults for broodstock so that they comprise an unbiased sample of the naturally spawning donor population with respect to spawning timing, size, age, sex ratio and any other traits identified as important for long term fitness.
- Consider a captive broodstock program if the target population is critically small and extinction is probable. Maintain a captive broodstock for only one generation.
- Within each group of adults that are "ripe" for spawning on a given day, randomize matings with respect to size and other phenotypic traits.
- For all fish collected as hatchery broodstock, choose the mating scheme that will maximize effective population size.
- Within each group of males and females that are "ripe" for spawning on a given day, cross one female with one male. If one sex is in excess, divide gametes from individuals of the less numerous sex to allow crosses with all adults of the excess sex. In cases where male infertility is frequent, pool semen from overlapping pairs of males and immediately use each pooled pair to fertilize one lot of eggs.
- Apply a factorial cross to as many matings as possible. For critically small populations consider a full factorial cross on each spawning date.
- Simulate the natural environment in incubation for the attributes of incubation densities, substrate, light, temperature and oxygen. Provide for volitional movement of swim-up fry to feeding areas in rearing troughs, raceways and ponds. Simulate natural juvenile rearing conditions for the attributes of rearing densities, container hydraulics, habitat complexity, feeding conditions, predator avoidance behaviours and fish size and nutritional status at release.
- Unless conducting experiments on effects of different rearing methods, rear all fish of a given population under the same conditions. Mix families randomly as soon as possible taking into consideration plans to mark families.
- The sum of the numbers of hatchery fish released and naturally reproduced fish (with none displaced) should be equal to or less than the estimated carrying capacity of the environment for juvenile fish.
- Release at the earliest life stage possible considering the trade-off between adult return rate and genetic risks.
- Release fish in locations where the target populations' naturally produced fish occur at the same life stage. Disperse release sites.
- Acclimate juveniles by exposing them to water from the target lake.

These guidelines should be continuously re-examined and revised to incorporate future research findings and lessons learned by ongoing hatchery program evaluation.

MILLER, M. Undated. Stocking assessments of Lakes Achseon, East Bull, Kecil, McLander, Rushbrook, and Shakwa. Ontario Ministry of Natural Resources. File Data. Ontario Department of Lands and Forests. Blind River, Ontario. 8 p.

Assessment netting was conducted on Acheson Lake after complaints of poor angling. Three overnight net sets (July 28-30, 1982) produced a catch of 13 lake trout and numerous lake herring. Angling with wire line for $1\frac{1}{2}$ hours produced 5 lake trout ranging from $\frac{1}{2}$-5 lb. None of the fish caught were mature. All trout were feeding on herring and perch. This is one of the most impressive lake trout lakes in the area. It is recommended that this lake not be stocked.

Lake trout stocking assessment was conducted on Kecil Lake from August 25-27, 1982. From eight net sets a total of 3 large (8-10 lb.) native lake trout and 800+ lake herring were caught. This appears to be an excellent lake trout lake but natural reproduction may be a problem. After stocking 5,000 lake trout for three consecutive years (1980-1982) no small lake trout were captured. It would appear that there is too much competition from the resident herring population which appears to be very high at all depths. Possibly stocking larger lake trout or lake trout backcross would be successful.

Netting was carried out on McLander Lake from July 26-28, 1982 to evaluate the success of previous lake trout stocking. No lake trout were caught and it was discovered that dissolved oxygen was marginal for lake trout. It is recommended that no further stocking of lake trout be undertaken.

Lake trout stocking assessment was conducted on Rushbrook Lake from August 9-13, 1982. Twenty net sets produced a catch of 30 lake trout (all small), one 3½ lb. brook trout, 138 lake whitefish, 58 suckers, 600+ perch and 15 cyprinids. There are definite oxygen problems in the lake and, although it seems to be improving, dissolved oxygen concentrations should be monitored and, if suitable, the lake should be restocked in the spring of 1984 and 1986.

Eighteen gill nets were set in Shakwa lake from August 16-18, 1982. The catch consisted of 71 lake trout, 245 lake whitefish, 42 suckers and 143 perch. There is a good return from earlier stocking. Several small (i.e., age 3+) lake trout were captured so there is some natural reproduction occurring.

Three small mesh gill nets were set in East Bull Lake on September 18, 1984 to determine the survival of stocked lake trout and the amount of natural reproduction which was occurring. The catch was comprised of 32 lake trout, 11 burbot, 5 suckers and 100+ smelt. Nine of the lake trout were stocked fish while 23 were native trout. It appears that there is a good naturally reproducing lake trout population in East Bull Lake and that stocking has minimal effect on the total population in the lake.

MILLER, R. R. and J. R. ALCORN. 1943. The introduced fishes of Nevada, with a history of their introduction. Transactions of the Fisheries Society 73 : 171-193.

At least 39 species and subspecies of fishes have been introduced into the waters of Nevada since 1873. Of these, 24 kinds are now known to occur in the state. A thorough survey of the exotic fishes has not been made, but specimens or records of introduced species have been kept in the course of rather extensive collecting of the native fish fauna from 1934 to 1943. Consequently it is believed that the number of introduced species herein enumerated approaches a complete tabulation. Some additions among the sunfishes and catfishes may be expected.

Concerning the lake trout or Mackinaw (*Cristivomer namaycush*) its arrival in Nevada dates back to 1885 when 100,000 eggs of this species were sent to the Nevada Fish Commissioner and apparently about three-fourths of these arrived in good condition. It is probable that some of these were planted, but no accurate account of their fate is available. The first definitely recorded plant was made in 1889 in and around Lake Tahoe, and a later plant was made there in 1895. On May 28, 1896 48,000 mackinaw trout were planted in Lake Tahoe, Douglas County. This fish is now very abundant in Lake Tahoe where it is accused of having greatly reduced or virtually eliminated the Lahontan cutthroat trout (*Salmo clarkii henshawi*) and the royal silver trout (*Salmo regalis*) particularly the latter species. In 1907-1908, 27,245 fry of this species was introduced into Walker Lake, Truckee River, and Lake Tahoe.

MINNESOTA DEPARTMENT OF NATURAL RESOURCES. 1982. Lake management planning guide. Fisheries Division Special Publication No. 132. St. Paul, Minnesota. 61 p.

This guide has been prepared to provide fisheries management guidelines, provide program continuity and promote modern fisheries management practices. Stocking is one option identified to improve a poor lake trout population. Guidelines for lake trout stocking may be summarized as follows:

- Lakes should provide appropriate habitat conditions for lake trout. This includes depths over 70 feet with at least 5.0 ppm of dissolved oxygen throughout the hypolimnion. Smelt or small coregonids should be present for forage.
- In lakes with inadequate reproduction, fingerlings (50-75/lb) should be stocked for 2-3 consecutive years at rates of 10-20 per surface acre. Yearling lake trout (10-15/lb) should be stocked at a rate of 5-10 per surface acre every other year. In lakes with predators and competitors, yearling lake trout should be stocked annually until survival can be assessed. In lakes with very few predators or competitors, fingerlings can be stocked at the rate of 40 fish per surface acre every other year.
- Assessment of stocked fish should be conducted using gill nets set in the preferred temperature zone (50-55° F). This often involves suspended nets during the summer. Netting should be done every 3-5 years on each lake and resurveys should be conducted every 10-20 years depending upon the rate of change of other environmental factors. Creel census should be conducted on lakes with heavy angler use to determine if stocked fish are being taken by anglers.

MITCHUM, D. L. and L. E. SHERMAN. 1981. Transmission of bacterial kidney disease from wild to stocked hatchery trout: Game and fish laboratory research. Wyoming Fish and Game Department. Cheyenne, Wyoming.

MONROE, B. P. and F. J. HICKS. 1985. Smoke Lake data summary. File Report. Algonquin Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Whitney, Ontario. 13 p. + tables.

The major fish species of Smoke Lake are lake trout (*Salvelinus namaycush*), lake whitefish (*Coregonus clupeaformis*) and smallmouth bass (*Micropterus dolomieui*). Lake trout and lake whitefish are native to the lake whereas smallmouth bass were introduced into Smoke Lake around the turn of the century. During the 1940s, cisco (*Coregonus artedii*) were successfully introduced as a forage fish for the lake trout. Stocking of lake trout has occurred periodically since the 1940s. Between 1948 and 1976, a total of 11,200 fry, 17,200 fingerlings, 16,500 yearlings and 1,500 two year old lake trout were stocked in Smoke Lake.

MOORE, S. J. 1984. Diet analysis of lake trout from five lakes in the Rideau Lakes Fisheries Assessment Unit. Report prepared for the Rideau Lakes Fisheries Assessment Unit, Ontario Ministry of Natural Resources, Sharbot Lake, Ontario. 22 p.

This report presents information on the diet of lake trout which were sampled from angler on five lakes (Big Clear, Big Rideau, Big Salmon, Charleston and Devil) in southeastern Ontario. All five lakes are stocked on an annual basis with lake trout.

On Big Rideau Lake fish were present in 90% of the lake trout stomachs. One shiner (genus *Notemigonus* or *Notropis*) was identified and the remaining fish were alewife (*Alosa pseudoharengus*). Opossum shrimp occurred in 10% of the stomachs sampled but consisted less than 1% of the total volume. Miscellaneous items (digested matter and one rock) made up the remaining 18% of the total volume.

Prey fish occurred in 75% of the trout collected from Devil Lake. The number of fish in each stomach ranged from 1 to 6 with an average of 2.1. Only about one-third of the prey fish could be identified. Three dace, one brook stickleback (*Culaea inconstans*) and one cisco (*Coregoninae*) were identified; shiners were also present. Prey fish accounted for 85% of the total volume of all food categories. Opossum shrimp were present in 40% of the trout examined and constituted 3% of the total volume of stomach contents.

Prey fish were present in every lake trout collected from Charleston Lake. The number of prey fish in each lake trout stomach ranged from 1 to 17 with an average of 5.3. All of the identifiable fish were alewife with the exception of one dace (*Chrosomus* spp.) Prey fish accounted for 85% of the total volume of all food categories. Opossum shrimp were present in 40% of the trout examined and constituted 3% of the total volume of stomach contents. Digested matter, rocks and plant parts made up the remaining 12% of the total volume.

All of the lake trout stomachs examined from Big Salmon Lake contained fish. All identifiable fish were members of the minnow family. The majority were dace but two shiners were also identified. The invertebrate family of opossum shrimp made up only 1% of the total volume but was present in 41% of the lake trout. In the miscellaneous category, one leaf, two rocks, one fly (*Diptera*) and one caddis fly (*Tricoptera*) casing was found.

Fish occurred in 65% of the lake trout collected from Big Clear Lake. Of those identified, they were predominantly dace but one shiner was also discovered. Opossum shrimp occurred in 60% of the stomachs examined but constituted only 3% of the volume of total stomach contents. Scuds (*Gammaroidea*) were found in one trout stomach.

MURPHY, D. 1970. 1970 creel census report for Charleston Lake and Lake St. Lawrence. File Report. Ontario Department of Lands and Forests. Kemptville, Ontario.

A creel census was conducted on Charleston Lake during the summer (June-August) period. Three hundred and sixty-two anglers exerted 661 hours of effort to catch 66 lake trout. Fifty-six of these lake trout were retained. Of fifty lake trout which were examined, 15 had fin clips (30%) indicating they were stocked fish.

MURRAY, A. R. 1979. The lake trout of Whelan Bay, Whiteswan Lakes, Saskatchewan: Status and management. Manuscript Report No. 6. Fisheries Branch. Department of Northern Saskatchewan Resources. Regina, Saskatchewan. 31 p.

MUTENIA, A., O. SIMOLA and O. TUUNAINEN. 1982. Results of lake trout stockings in Finland 1957-1981. p. 381-391. *In* EIFAC Symposium on Stock Enhancement in the Management of Freshwater Fisheries. Budapest, Hungary.

In 1955, lake trout eggs from Lake Superior were imported to Finland from the USA. In addition to fish for stockings, the eggs were used to cultivate brood fish at the two fish farms of the Fisheries Foundation. Stockings in the lakes began in 1958 with two-year-old juveniles. The Fisheries Foundation stocked circa 100,000 marked (Carlin tags) 2-3 year old, 17-22 cm long lake trout in eight different lakes as well as in the sea in various parts of Finland, especially in the lakes in Lapland. In the seventies, the Finnish Game and Fisheries Research Institute continued introductory stockings of lake trout.

Lake trout prefer cold water. For the most part they were stocked in large, deep, clear lakes which have a large volume of hypolimnion in the summer.

The results of the trials indicate that lake trout should be stocked at a length of 20-25 cm in the spring or late autumn when the water is cold. The best results were obtained in Lake Pallasjarvi in Lapland. The catch there was 237 kg/1,000 individuals stocked on 14 October 1966. Good results were also obtained in Lake Inari and Lake Iijarvi.

The only good results in small but deep and clear lakes (2 km^2) were obtained in southern Finland. Brown water lakes in general gave poor results. Stocking in the sea and brackish water also gave poor results.

Stockings in Lake Inari (1,000 km^2) were carried out over a period of ten years, with an average of 100,000 individuals/year of 2-3 year old juveniles. The present annual catch of lake trout is circa 10,000 kg. The fish weigh 1.0-1.5 kg, with the largest individuals weighing 6-7 kg. Most of the catch is taken in nets.

Reproduction of lake trout has taken place in Lake Pallasjarvi and apparently in Lake Inari as well. Trout generally feed on vendace and whitefish.

Cultivation of lake trout brood fish and juveniles in the fish farms of northern Finland is easier than, for example, that of salmon or sea trout.

NESLER, T. P. 1981. Studies of the limnology, fish populations, and fishery of Turquoise Lake, Colorado – 1979-80. United States Department of the Interior, Colorado Division of Wildlife. Fort Collins, Colorado. 24 p.

Turquoise Lake is a dimictic, cold water reservoir that is well oxygenated, relatively unbuffered and slightly acidic. Turquoise Lake may be classified as oligotrophic on the basis of total dissolved solids, algal nutrients (N, P) and chlorophyll concentrations. Some oxygen depletion in the reservoir's hypolimnion occurs regularly in late summer and late winter, though seasonal turnover and perhaps the outlet at the reservoir bottom prevents anoxic conditions from developing. The lake is limnologically similar to Twin Lakes in most aspects. Colder water temperatures and the introduction of *Tabellaria* and *Daphnia* in Turquoise Lake may have a noticeable impact upon the limnological character of Twin Lakes.

The fishery at Turquoise Lake is based on stocked, creel-sized rainbow trout. Though similar to Twin Lakes, a better catch rate for similar fishermen effort and stocking rate exists. The stocked rainbow trout return in the harvest at a relatively low level in one summer season but continue to contribute to the fishery the following season. Fall stocking of creel sized rainbow trout also appears to be quite effective in providing good catch rates the following spring. Catch rates have remained relatively high despite increased fishermen effort and similar levels of rainbow trout stocking between 1972, 1973, and 1980. In contrast to Twin Lakes this may be a result of significant contributions to the fishery from a previous year's stock of fish. Fall stocking and the absence of a significant population of lake trout.

Lake trout have been unable to establish a self-sustaining population in the reservoir. Recruitment to a size capable of creating a fishery similar to Twin Lakes and providing a predatory balance for sucker populations are negligible. Periodic stocking appears necessary to maintain a lake trout population in the reservoir.

NEVIN, J. 1892. Planting fry vs. planting fingerlings. Transactions of the American Fisheries Society 27 : 17-26.

Some years ago we planted 400 two-pound lake trout in one of our lakes at Madison. The following morning after the fish were planted, four of those same fish were brought to Mr. Dunning, the President of our Board, having been taken from the mouths of pickerel speared during the night; and I am of the opinion that not one of those fish lived twenty-four hours after they were set at liberty in the lake, and that they all became the prey of other fish. It was like placing a lamb in a lion's den for safekeeping.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION. 1979. Operational policies and criteria for fish stocking in New York. Bureau of Fisheries, Division of Fish, Wildlife and Marine Resources. Albany, New York. 9 p.

Allocation of stocked fish shall be directed toward obtaining maximum benefits for the angling public from each fish stocked. Stocking other than for put-and-take fisheries shall be based on optimum use of available carrying capacity for hatchery fish and shall include appropriate adjustments for the rate of removal by the fishery. In all waters with suitable reproductive habitat, species and strains capable of maintaining self-sustaining populations will be utilized to the maximum extent possible. Fingerling stocking policies will be used in preference to yearling policies wherever there is reason to believe fingerlings will produce comparable results in terms of survival, growth and utilization. Yearling stocked waters receiving over 3,500 fish will be scheduled for harvest evaluation by creel census, tagging or other appropriate means. Stocking rates will be based on the morphedaphic index (MEI). Base stocking rates will be as follows: Fingerlings: 30√MEI fish/acre; Yearlings: 15√MEI fish/acre. Base stocking rates may be modified in response to data on abundance of competitive species, trout growth rates, projected fishing pressure and contribution of natural reproduction.

NILSSON, N. A. and G. SVARDSON. 1968. Some results of the introduction of lake trout (*Salvelinus namaycush*) into Swedish lakes. Report of the Institute of Freshwater Research Drottingholm 48 : 5-17.

Beginning in 1959 about 70 Swedish lakes have been stocked with the North American lake trout (*Salvelinus namaycush*). The chief aim being to improve fishing in impounded or otherwise non-productive lakes.

The fish were mostly caught at considerable depths (15-25 m) but there is a tendency towards a more even vertical distribution in cold homothermal lakes.

The lake trout have fed mainly on fish (whitefish, smelt and perch), in the younger stages on crustaceans (*Mysis* and *Pallasea*), and the growth has been very variable, in the best case 3.6 kg in 6 years.

Survival has hitherto been low in fish released as young of year but very good in fish released as two year olds. Yearlings have given intermediate results. The best-rewarding release was made in Lake Storsjon with two-plus fish, ranging from 20 to 27 cm. The recovery of this lot in the first five years was 65% and the weight of the recapture was comparable to salmon smolt releases in the Baltic.

No natural reproduction has hitherto been observed in the lakes.

NOAKES, D. L. G. and R. A. CURRY. 1995. Lessons to be learned from attempts to restore *Salvelinus* species other than *S. namaycush*: A review of reproductive behavior. Journal of Great Lakes Research 21(Suppl. 1) : 54-64.

Published literature was reviewed on spawning and early rearing habitat of *Salvelinus* species, other than *S. namaycush*, for information on the success of attempts to introduce these species into new habitats, and to restore these species into habitats from which they had been eliminated. Competition from other fish species, particularly coregonids and salmonids, appears to lessen the chances of successful introductions of these species, whether to new or previously occupied habitats. Predation by esocids, osmerids and other salmonids is also a factor reported to reduce the likelihood of success of introductions and restoration attempts. Loss of spawning habitat and nursery habitat through siltation, eutrophication, or lowered water levels are additional variables preventing successful introductions or reintroductions. Restoration of historical spawning areas, or provision of new, suitable spawning habitat can lead to successful recruitment by introduced or reintroduced *Salvelinus* species. Stocking appropriate life stages was important for successful introductions or reintroductions. In general, older/larger fish were more likely to survive and reproduce after stocking.

NOLTING, D. H. 1958. Lake trout investigations. Colorado Job Progress Report, Project No. T-45. Colorado Department of Natural Resources. Denver, Colorado. 22 p.

This study was conducted to determine the value of lake trout or Mackinaw (*Salvelinus namaycush*) for use in Colorado lakes. This species has been reported in a total of 32 Colorado lakes. A group of 14 of these lakes was selected for study during the summer of 1958. Efforts were made to determine the presence or absence of lake trout, the condition and abundance of existing populations, lake trout habitat requirements, and their present and potential value to Colorado fisheries. Spawning operations were conducted at two of the lakes to investigate spawn-taking potentials and to facilitate tagging studies.

The records of past Mackinaw plants are incomplete. Little is known concerning plants made before 1947. A number of lakes were stocked with this species as early as 1900. The earliest record concerns a plant made in Twin Lakes in 1890. The 1958 survey showed that many of these early plants were successful.

Relatively recent plants of Mackinaw have been made in Deep Lake and Twin Lakes. A plant of 6,150 three-inch mackinaw was made in Deep Lake in 1951. In Twin Lakes, plants of 11,000 two-inch, 3,982 six-inch, and 71,780 two-inch mackinaw were made in 1947, 1951, and 1953, respectively. A total of six mackinaw in age group VII were taken from Deep Lake during 1958. These fish correspond to the 1951 plant. Mackinaw in the V, VII, and XI year age groups correspond to the plants made in Twin Lakes. Correlation between individual plants and numbers of fish taken in the sample is indicated in all cases. The best correlation is for the 1953 plant in Twin Lakes. A total of 18 fish in age group V were recorded, and this was the largest sample taken in any age group. It is probable that the majority of these fish originated from the 1953 plant of 71,780.

A total of 2,000 Mackinaw eggs from Deep Lake were hatched in the Glenwood Springs Unit during 1958. Temperatures during the hatching period ranged from 40 to 45 degrees. These temperatures are probably somewhat higher than would be found in a lake under normal conditions. The best hatching success usually occurs between 33-37 degrees.. A total of 1,162 1.7 to 2.5 inch mackinaw at 35 per ounce were reared from these eggs. These fish were marked by clipping the adipose fin before they were stocked. Losses from fin-clipping amounted to 50 fish. The marked fish were distributed as follows: Deep Lake – 970 (by truck on August 27); Savage Lake – 142 (by airplane on August 28).

These Mackinaw were clipped and handled in 50 degree water. The Deep Lake plant was hauled in 4 cream cans at 250 fish per can for a period of two hours without a loss. The temperature was 51 degrees at the start and was 58 degrees when the fish were planted. Since these temperatures are above the normal tolerance range for Mackinaw, a test was made to check on this factor before the fish were planted. Ten two-inch Mackinaw were exposed to 60 degree water for a period of 30 minutes without apparent ill effect. After stocking, the small mackinaw began moving gradually into deeper water. They seemed adept at seeking out hiding places in the weeds and rocks. A seine drag made two days after the plant yielded two of the marked mackinaw. These fish had not moved into deeper water and were apparently unaffected by the 58 degree temperatures.

The general condition of the fish of this plant of Mackinaw was poor. They looked poor physically and acted weak and sluggish. They began feeding on plankton immediately after they were planted. These fish were raised entirely on a diet of dry feed, and this diet is believed to be responsible for their poor condition.

NOLTING, D. H. 1963. More mackinaw for Colorado. Colorado Outdoors 12(1) : 30-31.

Mackinaw, Colorado's largest trout species, got a real boost during 1962. The largest plants of this experimental fish to date were made in seven different Colorado lakes and reservoirs. Most of the plants were small fish averaging 3-4 inches long, but if research promise bears out catches of large fish should become a reality within a few years.

In September, Grand Lake received a planting of 12,000 Mackinaw trout averaging 3$^1/_2$ inches in length. That's an average of 20 fish per acre. This is the third plant for that lake. The first two did well with the fish of the first plant now averaging from 12-13 inches in length. Gill net catches have shown that the number of Mackinaw are approximately equal to the numbers of other game fish. If this ratio holds up, Grand Lake should soon become one of our better Mackinaw fishing waters.

More than 38,000 Macks were planted in Granby Reservoir where a previous plant was made last year. Fish of the first planting now average from 6-7 inches. Granby, one of our largest reservoirs and one of the most difficult to manage, holds considerable promise for Mackinaw and it is believed that this species will be the answer to at least some of our problems.

A total of 17,000 Mackinaw were planted in Twin Lakes near Leadville. The upper lake received 6,000 of this total while the remaining 11,000 were stocked in the lower lake. All of these fish were marked by clipping a pair of fins and a different fin clip was used for each lake.

ODELL, T. T. and W. C. SENNING. 1937. Lakes and ponds of the Lower Hudson area. p. 104-123. *In* A Biological Survey of the Lower Hudson Watershed, Supplemental to The 26th Annual Report of the State of New York Conservation Department. Albany, New York.

Lake trout stocking in Crystal Lake has not been successful for a number of reasons. There is very little water of optimum depth and it is only fair chemically. Low oxygen content in the bottom waters seems to be characteristic of the ponds studied in Putnam County. This condition undoubtedly explains why lake trout stocking has not been successful in Indian Lake.

Few lakes in this drainage area provide deep cold water containing a large percent of oxygen which is necessary for the well being of lake trout. Lake trout are recommended for stocking in Croton Falls Reservoir, Lake Gilead, the west basin of the Ashokan and Kensico Reservoir. This species may be stocked in Lake Glenida also because it is already established there although the oxygen relationships in this lake are relatively poor in deep water. Depth, temperature and oxygen relations in the other reservoirs are unsuitable for lake trout and attempts to introduce them probably would be unsuccessful. Where lake trout are recommended it is desirable that they be planted in early spring or late fall because of the high temperature attained by the surface waters in the summer.

OLVER, C. H. 1967. Creel census report Chiblow-Denman lakes, 1967. File Report. Ontario Department of Lands and Forests. Sault Ste. Marie, Ontario. 26 p.

The closure of Chiblow and Denman lakes to fishing between October 15 and May 1 since 1956-57 dissatisfied many anglers, particularly in recent years when the closure of these lakes became quite a controversial subject. In an effort to resolve this dispute a creel census was conducted on Chiblow and Denman lakes in 1967 to determine if the continued closure of these lakes to winter fishing was warranted.

The majority of people contacted on these lakes between early May and late September were lake trout fishermen (63%). Smallmouth bass fishermen composed 19% of the total and pleasure boaters 18%. Lake trout fishermen spent 14,161 hours to catch 3,454 lake trout. The average rate of success was 0.24 fish per man-hour. The harvest of 6,955 pounds of lake trout represented a yield of approximately 1.2 pounds per acre. Lake trout age 5 and 6 composed the bulk of the observed catch (67%). No hatchery planted trout were seen among 587 fish examined.

OLVER, C. H. 1968. Experimental planting of tagged lake trout in Basswood Lake, November 1968. File Report. Ontario Department of Lands and Forests. Sault Ste. Marie, Ontario. 9 p.

More than 1,200 slow-growing lake trout which had been held at the Tarentorus Trout Rearing Station for brood stock purposes were made available to the Sault Ste. Marie District for planting in October 1968. Oval, streamer tags were applied to 1,213 fish. Only 7 fish lost tags prior to planting and these tags were retied. One fish had lost its tag during planting and this fish escaped into the lake with no tag. Pre-planting mortality was limited to 4 fish.

The lake trout were transferred by tag number sequences into 4 different lots, one lot in each of four partitioned raceway sections. The number of fish and the tag number of each fish in each lot was recorded.

A total of 611 lake trout were transferred to Basswood Lake by truck on Friday, November 8. These fish were planted in a bay along the south shore of the lake. On Tuesday, November 12, the remaining fish were transferred to Basswood Lake in 2 trips by means of a Turbo-Beaver. These fish were released at 3 different locations. Two of the locations were in the open water portion of the lake with a water depth of greater than 200 feet. The third location was in 30-40 feet of water about 200 feet from a small island. In each case the aircraft landed and fish were released at water level.

The 1,208 tagged lake trout weighed a total of 573.4 pounds. The average total length was 11.9 inches and the average weight was 7.6 ounces. Individual weights ranged from 2 to 17 ounces.

Any difference between the catch of shore-planted lake trout and the open-water plant will be recorded in the Basswood Lake creel census.

OLVER, C. H. 1970. The 1970 lake trout sport fishery – Flack Lake with a summary of angling results, 1968-1970. File Report. Ontario Department of Natural Resources. Sault Ste. Marie, Ontario. 32 p. + appendices.

The third year of a five year creel census was completed in 1970. Data are presented for the 1970 fishing season and angling results are summarized for the past three years. Fishing pressure decreased each year since the inception of the census in 1968, whereas the catch rate (CUE) increased annually. A major change in the age composition in 1970 resulted in an increased percentage of younger, smaller, and lighter fish in the catch compared to the two previous years. The reduction in weight harvested in 1970 compared to 1968 and 1969 exceeded the numerical reduction in catch during the same period of time. The contribution of hatchery-reared lake trout to the fishery is also discussed. The estimated yield (pounds per acre) was 1.037 in 1968, 1.137 in 1969, and 0.838 in 1970.

OLVER, C. H. 1971$_a$. The 1968 Flack Lake lake trout sport fishery. File Report. Ontario Department of Lands and Forests. Sault Ste. Marie, Ontario. 17 p.

A creel census was initiated on Flack Lake in 1968 and encompassed the entire fishing season from May 1 to October 10. Most of the anglers interviewed were Ontario residents (81.4%) and only 18.4% were citizens of the United States. The majority of the anglers were day-trippers (72.4%) and 22.8% were campers from the Semiwhite Lake provincial campground.

Most anglers used the park access to either launch boats for trolling or to fish from the shore. Catch statistic estimates were computed for these anglers. The owner of the tourist camp and fishermen from a privately owned camp on the lake provided monthly catch totals to the creel census clerk. The estimated catch of all lake trout anglers in 1968 was 1,863 fish at a total weight of 2,536.6 pounds. The yield was 1.079 pounds per acre. The CUE season average was 0.189 fish per man-hour.

The average total length of the lake trout sampled was 16.6 inches and the average round weight was 1.4 pounds. The largest lake trout reported caught weighed 20.0 pounds.

Females were more prevalent than males as 315 fish (56%) were females and 247 fish (44%) were males. Male lake trout first attain sexual maturity at age V+ and females probably at age VI+.

The catch was dominated by age VI fish (51.2%) and was supported essentially by age V (34.7%) and age VI fish which together formed 84.9% of the aged sample. Age IV and age VII fish comprised only 6.9 and 5.3% of the catch, respectively. The average age to the 608 fish sampled was 5.6 years.

Lake trout in the 15-inch (22.7%), 16-inch (26.1%), and 17 inch (19.2%) classes were the dominant inch groups in the catch and together formed 68% of the sample. The 6 inch size range between 14.0 and 19.9 inches contained 92.2% of the fish examined. Forty-eight percent of the observed catch weighed between 1.0 and 1.4 pounds and fish less than 2.0 pounds formed 87.7% of the sample.

Only one of the 642 lake trout examined by the census clerk was fin clipped. This fish was from the 1964 plant and the estimated number of fish of the 1964 plant captured in 1968 was 3. The percentage return was 0.06. No lake trout from the 1965 or 1966 plants were observed in the creel census.

OLVER, C. H. 1971$_b$. The 1968 lake trout sport fishery – Semiwhite Lake. File Report. Ontario Department of Natural Resources. Sault Ste. Marie, Ontario. 16 p. + appendices.

A creel census was initiated on Semiwhite Lake in 1968 which covered the entire fishing season from May 1 to October 10. An estimated 884 anglers fished 2,847.5 hours to catch 617 lake trout. The CUE season average was 0.227 fish per man-hour. The lake trout averaged 14.5 inches, total length and 0.9 pounds round weight. The total weight harvested was 583.5 pounds for a yield of 0.776 pounds per acre.

Age groups IV (30%), V (22.1%) and VI (36.4%) combined comprised 88.5% of the aged fish. The average age was 5.1 years. Almost three-quarters (72.5%) of the fish were less than 16 inches in length, and only 4.2% were more than 19 inches in length. The majority of the fish (61.4%) weighed less than 1.0 pound and only 4.8% were greater than 2.0 pounds. Five lake trout from the 1965 plant (0.17%) were estimated to have been caught in 1968. No marked lake trout from the 1964 or 1966 plants were observed during the census.

Limited creel census information from 1963 and 1965 was compared with the 1968 data. It is suggested that fishing pressure between 1963 and 1968 resulted in a restructuring of the lake trout population to younger, smaller, and lighter fish by 1968.

OLVER, C. H. 1971$_c$. The 1969 lake trout sport fishery – Flack Lake with a summary of angling results, 1968-1969. File Report. Ontario Department of Natural Resources. Sault Ste. Marie, Ontario. 17 p.

The second year of a five year creel census was completed in 1969. The census covered the period from April 26 (opening day) to September 10. Ontario residents comprised the majority of the anglers interviewed (83.2%) and United States citizens formed 16.8% of the total. Day-trippers (71.5%) were the most prevalent group and 21.9% of the fishermen checked were campers from the Semiwhite provincial campground.

The estimated catch of all anglers up to September 10 was 1,946 lake trout at a total weight of 2,671.5 pounds. The yield was 1.137 pounds per acre and the CUE season average was 0.215 fish per man-hour.

The average total length of the fish sampled was 16.8 inches and the average round weight was 1.4 pounds. The largest lake trout recorded in the census was 12.0 pounds. The 209 males (50.7%) and the 203 females (49.7%) sampled represented a 1:1 sex ratio.

The catch was dominated by age VI fish (53.0%) and was supported essentially by age V (21.4%) and age VI fish which together formed 74.4% of the aged sample. Age IV and age VII fished comprised 8.7 and 12.5% of the catch respectively. The average age of the 415 fish sampled was 5.8 years.

Lake trout in the 15 (17.1%), 16 (26.2%) and 17 inch (20.0%) classes were the dominant inch groups in the catch and combined formed 63.3% of the sample. The 7 inch size range between 13.0 and 19.9 inches contained 90.7% of the fish examined. Fish between 1.0 and 1.4 pounds formed 43.5% of the observed catch and lake trout less than 2.0 pounds comprised 87.0% of the sample.

One fish from the 1964 plant was recorded in the census. The estimated number of the 1964 plant caught in 1969 was 5 fish or 0.1%. Two fish from the 1965 plant were observed and the estimated catch was 9 fish or 0.3%. No lake trout from the 1966 plant were observed in the 1969 creel census.

Catch and yield estimates in 1969 were similar to those realized in 1968. The 1968 season estimates (May 1 – October 10) were 1,863 lake trout at a total weight of 2,536.6 pounds of 1.037 pounds per acre. The 1969 season estimates (April 26 – September 10) were 1,946 fish at a total weight of 2,671.5 pounds or 1.137 pounds per acre. The CUE increased from 0.189 fish per man-hour in 1968 to 0.215 in 1969.

Age group VI was the single dominant age group in 1968 (51.2%) and 1969 (53.0%). Age groups IV-VII formed 98.1% of the catch in 1968 and 95.6% in 1969. Together age groups V and VI supported the fishery in 1968 (85.9%) and 1969 (74.4%).

The 7-inch size range (13.0-19.9) accounted for 95.8% of the 1968 sample and 90.7% of the 1969 sample. Three inch single groups (15, 16, 17) dominated the catch in 1968 (68.0%) and 1969 (63.3%). The largest single percentage of fish occurred in the 1.0-1.4 pound category with values of 48.o% in 1968 and 43% in 1969. Lake trout less than 2.0 pounds formed 87.7% of the sample in 1968 and 87.0% in 1969.

The estimated catch of the 1964 plant in 1968 and 1969 was 8 fish or 0.16% of the number stocked in 1964. The estimated catch of the 1965 plant in 1968 and 1969 was 9 fish or 0.30% of the number released in 1965. No lake trout from the 1966 plant were recorded in either 1968 or 1969.

A reduction in the daily catch limit of lake trout from 5 to 3 could have reduced the harvest in 1968 by 9.5%. Initiation of a 3 fish daily limit in 1969 could have reduced the catch in that year by 14.8%.

OLVER, C. H. 1971$_d$. The 1969 lake trout sport fishery – Semiwite Lake with a summary of angling results, 1968-1969. File Report. Ontario Department of Natural Resources. Sault Ste. Marie, Ontario. 13 p + appendices.

The second year of a five year creel census project was completed in 1969. Data are presented for the 1969 fishing season and angling results are summarized for the past two years. Catch-effort estimates for 1969 were slightly greater than those realized in 1968. The 1968 season estimates (May 1-October 10) were 617 lake trout at a total weight of 583.5 pounds or 0.776 pounds per acre. The 1969 season estimates (May 1-September 10) were 722 lake trout at a total weight of 635.3 pounds or 0.845 pounds per acre. The CUE increased from 0.227 fish per man-hour in 1968 to 0.254 in 1969.

The estimated catch of the 1964 plant of lake trout in 1968 and 1969 was 10 fish or 0.2% of the number stocked in 1964. The estimated catch of the 1965 plant in 1968 and 1969 was 5 fish or 0.17% of the number released in 1965. No lake trout from the 1966 plant were recorded in either 1968 or 1969.

OLVER, C. H. 1971$_e$. The 1970 lake trout sport fishery – Semiwite Lake with a summary of angling results, 1968-1970. File Report. Ontario Department of Natural Resources. Sault Ste. Marie, Ontario. 21 p. + appendices.

The third year of a five year creel census project was completed in 1970. Data are presented for the 1970 fishing season and angling results are summarized for the past three years. Fishing pressure remained fairly constant since the inception of the census in 1968 whereas the catch rate (CUE) increased annually. The estimated yield (pounds per acre) was 0.776 in 1968, 0.845 in 1969 and 0.650 in 1970. An increased percentage of younger, smaller and lighter fish occurred in the 1970 catch compared to the two previous years. The catch of hatchery-stocked lake trout was only 0.2% for the 1964 plant and 0.27% for the 1965 plant. No lake trout from the 1966 plant were recorded through 1970.

OLVER, C. H. 1971_{f}. The 1971 lake trout sport fishery – Semiwite Lake with a summary of angling results, 1968-1971. File Report. Ontario Department of Natural Resources. Sault Ste. Marie, Ontario.

The fourth year of a five year creel census project was completed in 1971. Data are presented for the 1971 fishing season and catch-effort statistics are summarized for the four year period 1968-1971. The age, size, and weight composition of the catch was analyzed for the years 1963, 1965 and 1968-71. The contribution of three different plants of hatchery-reared lake trout to the sport fishery was also determined.

Fishing pressure was quite constant between 1968 and 1970 but decreased 16% in 1971 to 2,361 man-hours compared to the three year average of 2,811 man-hours. The rate of success (CUE) increased annually from 0.227 fish per man-hour in 1968 to 0.54 in 1969, 0.271 in 1970 and 0.317 in 1971. The catch increased from 617 fish in 1968 to 722 fish in 1969 and declined to 694 fish in 1970 and 679 fish in 1971. The annual estimated yield (pounds per acre) was 0.776 in 1968, 0.845 in 1969, 0.650 in 1970, and 0.697 in 1971. The four year average was 0.742 pounds per acre.

Lake trout age VI and older have been replaced by fish age V and less in the angler's catch. Fish age IV and older formed 86.8% of the catch in 1963 but only 10.8% in 1971. Fish age V and less formed only 13.2% of the catch in 1963 compared to 89.1% in 1971. The age of maximum vulnerability decreased from VI to IV. Lake trout less than 16 inches replaced larger fish in the catch and formed 89.9% of the catch in 1971 compared to only 17.6% in 1963. The majority of the fish sampled in 1963 weighed 2 pounds or more. Most of the fish caught since 1968 have weighed less than one pound and the percentage of fish less than one pound increased from 5.9 in 1963 to 74.8 in 1971. The changes in the age, size and weight composition of the catch are attributed to the effect of angling on the lake trout population.

The catch of hatchery-reared lake trout has been negligible. The total estimated catch of the 1964 and 1965 plants was approximately one quarter of one percent each. No fish from the 1966 stocking have been reported through 1971.

OLVER, C. H. 1972_{a}. The 1971 lake trout sport fishery of Flack Lake with a summary of angling results, 1968-1971. File Report. Ontario Department of Lands and Forests. Sault Ste. Marie, Ontario. 49 p.

The fourth year of a five year creel census project was completed in 1971. Data are presented for the 1971 fishing season and catch-effort statistics are summarized for the four year period 1968-1971. Changes were recorded in the age, size, and weight composition of the catch. The contribution of three years of hatchery-reared lake trout plants to the sport fishery was also determined.

Fishing pressure, as measured by the park boat fishery, declined annually between 1968 (6,685.5 man-hours) and 1970 (5,394.6 man-hours) and the net effect was a decrease in effort of 19.3%. The fishing pressure increased 17.4% in 1971 (6,336.2 man-hours) compared to the low recorded in 1970. The rate of success (CUE) increased annually from 0.191 fish per man-hour in 1968 to 0.216 in 1969, 0.253 in 1970, and 0.311 in 1971.

The harvest of lake trout, particularly the number of fish caught, exhibited only minor changes between 1968 (1,863 fish, 2,536.6 pounds), 1969 (1,964 fish, 2,671.5 pounds), and 1970 (1,656 fish, 1,968.5 pounds). The 1971 season estimates of 2,900 fish and 3,249.3 pounds exceeded the previous maximum values recorded in 1969 by 47.7% for the number and 21.6% for weight. The annual estimated yield (pounds per acre) was 1.037 in 1968, 1.137 in 1969, 0.838 in 1970, and 1.383 in 1971. The four year average was 1.109 pounds per acre.

Lake trout age VI and older are being replaced by fish age V and less in the angler's catch. Fish age VI and older formed 68.8% of the catch in 1969 compared to 29.0% in 1971. Fish age V and less formed only 31.1% of the catch in 1969 compared to 71.1% in 1971. The age of maximum vulnerability decreased from VI in 1968 and 1969 to V in 1970 and 1971. Lake trout less than 16 inches in total length are gradually replacing larger fish in the catch as fish less than 16 inches formed 70.1% of the catch in 1971 compared to only 36.6% in 1968 and 32.0% in 1969. The weight composition of the catch also declined and the percentage of fish less than 1.5 pounds increased from 64.7 in 1968 to 88.1 in 1971. The percentage of mature and maturing females decreased from 29.2 in 1968 and 30.4 in 1969 to only 11.0 in 1970 and 2.9 in 1971. The high exploitation rate (0.38) suggests that there is an intensive fishery for Flack Lake lake trout and that the observed declines in maturity and age and size composition are attributable to the effect of angling on the lake trout population.

The contribution of marked, hatchery-reared yearling lake trout has been negligible as less than one-third of one percent of all the fish checked at Flack Lake since 1968 have been of hatchery origin.

OLVER, C. H. 1972$_b$. Lake trout investigation – Horner Lake October, 1972. File Report. Ontario Department of Lands and Forests. Sault Ste. Marie, Ontario. 3 p.

A lake survey was conducted on Horner Lake in July 1966. Brook trout was the only game fish present at the time leaving a large volume of deeper water which was unutilized by any sport fish species. Lake trout were introduced to Horner Lake in 1969 and additional plants were made in 1970 and 1972. A total of 5,000 yearlings from Lake Manitou strain were stocked from an aircraft on each occasion.

In October 1972, small mesh gill nets were used to capture lake trout for assessment purposes. A total of 18 fin clipped lake trout, 4 brook trout and one white sucker were captured during the two overnight sets. No unmarked lake trout occurred in the catch. Sixteen (16) of the fish were from the initial introduction in 1969. There was no regeneration of the left ventral fin on 8 of the 16 fish. Partial regeneration of the left ventral fin was observed on 8 fish. Two lake trout from the 1970 plant were captured and neither exhibited any regeneration of the left pectoral fin.

Survival and growth of the initial stocking (1969) can be considered as excellent. The capture of only 2 immature females suggests the possibility that not all introduced lake trout populations are capable of spawning for the first time at age IV.

This project should be continued in October 1973.

OLVER, C. H. 1973. The status of the lake trout (*Salvelinus namaycush*) in the northeastern region: Problems and policy. Ontario Ministry of Natural Resources. Sault Ste. Marie, Ontario. 8 p.

Fish planting has a long and storied history in Ontario. For many years the value of stocking was unquestioned although its limitations as an effective "cure-all" are well known today. The attitude of the general public, however, still seems to be that our fisheries continue to exist only because of government hatchery programs. If this attitude is still prevalent we have done a poor job of informing and educating the public.

In retrospect, it appears that we have failed in our attempts to supplement natural populations with yearling lake trout. Numerical returns in the order of 0.5% (Opeongo, Temagami, Flack, Semiwhite) are the rule rather than the exception. That is, for every 200 fish released only one is eventually caught by an anglers. It would seem that planting over an existing natural population is an attempt to stockpile fish to create an artificially high level of production. The question arises as to where these additional fish will acquire the nutrients required for maintenance and growth in what are nutrient poor lakes.

The purpose of supplemental planting is to increase the number of fish in the anglers creel. Present methods in use have not worked satisfactorily. Perhaps the answer is to plant more fish. although percentage returns would remain low the number of returns in theory would increase. This approach is considered too costly and it also does little to enhance the art of fishery management. Perhaps the real issues is whether we should be planting for the purpose of supplementation.

Hatchery returns have been increased significantly by increasing the size of fish planted. Experiments in Ontario with stocking two year old fish instead of yearling lake trout show considerable promise although the results to date are incomplete. Researchers have found that the average size of lake trout at release was more closely related to survival than any other factor. Many have concluded that a size of 17-20 fish per pound appears to be close to optimum. Yearling plants of lake trout reared at the Tarentorus Hatchery have on occasion exceeded 100 fish per pound and currently average about 50 fish per pound. The likelihood of success would range from poor to very poor which has been our experience. Those districts which have planted extensively with fin clipped yearling lake trout for supplemental purposes view the great majority of these efforts as failures.

In the absence of better information it is suggested that the best corrective measure to improve our lake trout plantings is the use of larger fish than currently produced as yearlings in our hatcheries. Lake trout should average 20 fish per pound when planted. The number of fish available for stocking will be significantly reduced but it is probably that we will improve our present unsatisfactory planting record.

Occasionally lakes are surveyed in which lake trout do not occur although environmental conditions for the species appear suitable. Fish passage was likely blocked at some stage of deglaciation. The species composition of these lakes is limited and a few lakes may be barren. Lakes devoid of lake trout may also be quite deep. Introductions of yearling lake trout have been successful in establishing naturally reproducing populations. This is a sound management tool which should be implemented where conditions merit. A single plant of low stocking density can be sufficient. It may be necessary to impose sanctuary status on these lakes until reproduction has occurred or even until the first products of natural reproduction have themselves spawned.

Put-and-take fisheries for lake trout are not feasible and the use of natural ecosystems as put-and-take "fish ponds" for lake trout should not be permitted.

OLVER, C. H., R. L. DesJARDINE, C. I. GODDARD, M. J. POWELL, H. J. RIETVELD and P. D. WARING. 1991. Fish stocking and species interactions. p. 45-56. *In* Lake Trout in Ontario: Management Strategies. Lake Trout Synthesis Working Group, Ontario Ministry of Natural Resources. Toronto, Ontario. 90 p.

The stocking of lake trout has been widely practised in Ontario. Lake trout are usually planted to rehabilitate depressed stocks, introduce the species into "barren" lakes or to maintain sport fisheries by supplementing existing self-sustaining stocks. Regardless of the purpose, stocking has been one of the major and largely unchallenged management techniques used to satisfy the ever increasing demand for lake trout. About 500 lakes in Ontario have been stocked with lake trout. We recommend that:

- Supplemental stocking of lake trout not be permitted.
- Rehabilitation stocking not be permitted in lakes where native lake trout still exist, unless native stocks are used.

- Stocking be permitted to rehabilitate lakes in which the native stock has become extinct or to extend the range of lake trout.
- Stocking be permitted in the few lakes in Ontario which can be legitimately classified as put-grow-take, all of these lakes should be assessed to ensure that native stocks do not exist.
- Inland lakes which require rehabilitative stocking be closed to exploitation for lake trout until the process is complete.
- New species should not be stocked into lake trout lakes.

OLVER, C. H. and C. A. LEWIS. 1977. Reproduction of planted lake trout (*Salvelinus namaycush*) in Gamitagama, a small Precambrian lake in Ontario. Journal of the Fisheries Research Board of Canada 34(9) : 1419-1422.

Yearling lake trout (*Salvelinus namaycush*) stocked in 1961 in Gamitagama, an Ontario lake previously without this species, established a self-reproducing population. Planted fish first spawned at age 4+ in 1964 to produce the 1965 year-class. Four year-classes of naturally reproduced lake trout were present in the lake by 1969.

ONTARIO FEDERATION OF ANGLERS AND HUNTERS. 1986. Brief on the management of lake trout in Ontario. Paper submitted to the Minister of Natural Resources. January, 1986. Peterborough, Ontario. 12 p.

For may years, Ontario anglers have considered lake trout (*Salvelinus namaycush*) to be one of our most important sport fish. In recent years the Ontario Federation of Anglers and Hunters has heard considerable concern expressed about the survival of this species and many ideas have been put forth as to what might be done to restore, or at least to enhance, this fishery.

Supplementing lake trout populations with hatchery-reared fish seemed to help in some cases as a large percentage of the fin clipped fish showed up in angler's creels. In other cases it did not help; it seemed as if the hatchery-reared fish were not compatible with the native fish. Hatchery planting results have been variable but hatchery returns have increase significantly by increasing the size of the fish planted. Stocking is often most successful using fish of an average size of 36-44 fish kg^{-1} (17-20 lb^{-1}).

With respect to stocking several proposals are made:

- In some lakes, it has been determined that native gene pools of lake trout still exist. These gene pools should be protected to allow them to rebuild and flourish.
- In lake trout lakes with no native or special gene pool of lake trout or where it appears that the gene pool has been eliminated, put a fishery in place supplemented with other species on a put-and-take basis while attempts to rehabilitate the lake trout fishery are undertaken, if the forage base will support all species.
- In lakes where the lake trout gene pool can be identified and lake trout of a compatible gene pool are available for stocking these should be stocked with marked fish that average no more than 20 lb^{-1}.
- Provide new or upgraded hatchery capacity to produce the fingerlings required.

ONTARIO MINISTRY OF NATURAL RESOURCES. 1973. Lake trout plantings. p. 17. *In* Fishing in Algonquin Park. Whitney, Ontario.

Extensive lake trout plantings have been made over the years particularly in those more heavily fished lakes accessible by road. Lake Opeongo, the most heavily fished lake, has received the most generous plantings.

Tens of thousands of trout were planted there in the years between 1948 and 1959. Up to 1962 less than 25 of these hatchery fish had been reported caught in Lake Opeongo. Various planting techniques have been attempted to improve the survival rate. Evidence from Algonquin Park and elsewhere suggests that water quality and source of stock may be a limiting factor in survival. In 1961 and 1962 eggs were collected from softwater lakes in the park and from hard water Lake Simcoe. Each lot was subsequently raised in both hard and soft water and released as yearlings into Lake Opeongo. Returns, however, have been very low (less than one percent) leaving the question of water quality as a factor in survival still in doubt. It is planned to continue the experiment in 1973 and 1974 using two year old trout rather than yearlings.

ONTARIO MINISTRY OF NATURAL RESOURCES. 1976. Guidelines for stocking of hatchery fish. Draft Policy. Fish Culture Section, Fisheries Branch. Toronto, Ontario. 22 p.

This report presents draft guidelines for discussion which in modified form can become a new statement of Ministry policy. It is also intended to assist in priorizing fish requirements. Guidelines which apply to lake trout may be summarized as follows:

- Lakes to be stocked must have public access to justify stocking. Difficulty of access may differ with the season and location of the lake.
- Stocking should not be done without a previous aquatic habitat inventory (lake) survey.
- An oxygen value less than 5 ppm precludes stocking of hatchery-reared fish.
- For rehabilitory and introductory stocking, suitable spawning grounds should be available at the point of stocking.
- Lake trout should be stocked in lakes greater than 100 acres in surface area.
- For lakes being stocked with lake trout, the maximum depth should be greater than 50 feet and depths greater than 100 feet are best.
- Most trout waters have total dissolved solids (TDS) of less than 50 ppm (e.g., over 80% of lake trout lakes).
- The morphoedaphic index (MEI) should generally be less than 2.

ONTARIO MINISTRY OF NATURAL RESOURCES. 1982. General guidelines for stocking hatchery fish. Interim Guidelines. Fish Culture Section, Fisheries Branch. Toronto, Ontario. 21 p.

Pursuant to the general policy for stocking fish in Ontario, guidelines specific to individual waters need to be examined. The purpose of these guidelines is to assist fisheries managers throughout the province to design fish stocking programs which make the most efficient and effective us of our fish hatchery products

Guidelines which pertain to lake trout may be summarized as follows:

- As a general criterion, minimum dissolved oxygen levels should be > 5 mg L^{-1} in the summer and > 4 mg L^{-1} in the winter.
- Stocked waterbodies should meet thermal requirements of various species. The temperature of the waterbody should not reach a level less than a 2° C difference from the upper incipient lethal temperature at any time during the year. For lake trout the preferred temperature range is 8-15° C and the upper incipient lethal is 23.5° C.
- Suitable lakes for lake trout are generally greater than 41 ha in surface area and exceed 15 m in depth.
- Stocking rates for lake trout will be determined by the following method: Where the metric MEI is > 3.3, 0.4 kg of yearling lake trout should be stocked per hectare of water between 15 and 46 m in depth. Where the metric MEI is < 3.3, 0.2 kg of lake trout yearlings should be stocked per hectare of water between 15 and 46 m in depth.

ONTARIO MINISTRY OF NATURAL RESOURCES. 1989. Lake trout lakes in Ontario. Lake Trout Community Synthesis. Fisheries Branch. Toronto, Ontario. 67 p.

This listing of known lake trout lakes in Ontario was compiled as part of the Lake Trout Community Synthesis. Included in the listing are all known lakes which contain, or once contained reproducing populations of lake trout as well as those which are maintained by plantings of lake trout.

Ontario is currently known to have 2,318 lakes containing lake trout, 1,827 of which are designated as native populations. In 353 instances lake having native lake trout populations are stocked with either hatchery-reared lake trout (native and non-native stocks) or F_1 splake. There are at least 222 instances where lake trout stocks are the result of introductions.

ONTARIO MINISTRY OF NATURAL RESOURCES. 1991. Provincial fish stocking assessment guidelines. Draft guidelines. Fisheries Policy Branch. Toronto, Ontario. 8 p. + appendices.

Standardized fish stocking assessment guidelines are required to provide field staff with a consistent, objective approach to the evaluation of stocking effectiveness and to enable comparison of results of stocking assessments within districts and regions and across the province.

The following assumptions and principles were used in developing these guidelines:

- Quantified stocking objectives are required.
- Assessment of stocked fish is a management requirement.
- Required frequency of assessment will vary according to the stocking purpose and species involved.
- Sampling design must be statistically sound.
- Sampling programs should be "low impact" in terms of the number of fish to be lethally sampled.
- Standardized assessment techniques are applicable to all (MNR and external) stocking proponents.

ONTARIO MINISTRY OF NATURAL RESOURCES. 1995. Management plan for naturally reproducing populations of brook trout and lake trout in southcentral Ontario. Report prepared by the Brook Trout/Lake Trout Management Committee. Bancroft, Ontario. 32 p.

Recent studies have recommended that supplemental stocking should be discontinued in all lakes which have natural reproduction. This would eliminate the negative impacts that hatchery fish have on a naturally reproducing population. Naturally reproducing fish populations are valuable because they provide predictable and sustainable benefits with minimal long term cost to society.

To ensure the survival of naturally reproducing lake trout populations:

- Supplemental stocking into lakes which can sustain a naturally reproducing population of lake trout will be discontinued.
- Stocking is permitted in lakes which have no natural reproduction or for which reproductive status is undetermined.
- Stocking is permitted to rehabilitate lakes in which the native stock has become extinct or to extend the range of lake trout.

ONTARIO MINISTRY OF NATURAL RESOURCES. 1999. Stocks Catalogue. Fish Culture Section, Fish and Wildlife Branch. Peterborough, Ontario.

The stocks catalogue is designed to provide clients of the Ontario Ministry of Natural Resources (OMNR) fish culture program with basic information on the fish culture system, the hatcheries and the species and stocks of fish available from that system. The information in this catalogue reflects conditions current to 1999. The primary objective of the stocks catalogue is to facilitate application of the "stock concept" in fisheries management by providing relevant information on, and recommended use of, the various species and stocks of fish available from the OMNR fish culture system.

There are currently 12 different strains of lake trout in the provincial fish culture system. Seven of these are from inland waters (Big Rideau Lake, Charleston Lake, Devil Lake, Killala Lake, Lake Manitou, Lake Simcoe and Seneca Lake) while five strains (Big Sound, Iroquois Bay, Michicicoten Island, Mishibishu Lake, Slate Islands) are of Great Lakes origin.

The Killala Lake strain is most commonly used to stock softwater inland lakes while the Lake Manitou strain is used most often for plantings in hardwater inland lakes.

ONTARIO MINISTRY OF NATURAL RESOURCES. 2000$_a$. Best management practices for fish stocking inland waters of the Northeastern Region. Unpublished guidelines. South Porcupine, Ontario. 14 p.

These best management practices for fish stocking have been developed as a starting point for making sound stocking decisions. Stocking decisions made outside these best management practices should reflect either sound science, recommendations from stocking assessment and/or local knowledge which is defensible.

The best management practices for lake trout stocking may be summarized as follows:

- Lakes stocked for put-grow-and-take purposes should have a pH > 5.5 and suitable late summer habitat with water colder than 15° C and more than 5 ppm dissolved oxygen.
- Stocked lakes should not have existing viable populations of lake trout (viability of existing population of lake trout should be determined by looking at the following parameters: stock origin (native or stocked), mean depth greater than hypolimnetic depth, maximum depth greater than 21 m, percentage of clipped to unclipped fish, size of clipped fish, relative abundance and biological parameters of the population derived from spring littoral index netting (SLIN).
- The stocking rate should be a maximum of 0.2 kg fish per hectare of lake surface area.
- Stocking should be conducted every second year at the maximum rate or annually at the rate of 0.1 kg per hectare.

ONTARIO MINISTRY OF NATURAL RESOURCES. 2000$_b$. Fish transportation and stocking. Chapter 12. *In* 2000 Fish Culture Course Manual. Fish Culture Section, Fish and Wildlife Branch. Peterborough, Ontario.

Stocking is the final stage of the fish culture operations and is critical to the success of both the fish culture program and the fisheries management program for which the fish were produced. The procedures involved in harvesting the fish from the rearing units, transporting them to the stocking site and introducing them into the lake or river are critical to both the immediate post-stocking and long-term survival of the fish.

Transportation and stocking intensifies the fish culture process. The fish are subjected to a number of physiological stressors resulting from handling and crowding during harvest, crowding and deteriorating water quality in transportation containers which have no water exchange, possible repeat handling if transfer to subsequent transportation containers is required, and finally release to fend for themselves in the wild; all compressed into a time frame that may vary from an hour to several hours depending upon the distance between the fish culture station and the stocking site.

The design and successful operation of fish transportation equipment requires a thorough understanding of the physiological requirements of fish, the physiological responses of fish to stress, water chemistry and fish-water interactions. Success in transporting fish is determined by the ability to mitigate the physiological problems created for fish exposed to multiple stressors and held in a relatively small volume of water at relatively high densities for a number of hours. The life support system must prevent or minimize the adverse water quality changes and meet the physiological needs of the fish. As well, fish handling procedures during loading and release must minimize the stress as much as possible. The corticosteroid hormone response has shown that the stress of the initial harvest (crowding and netting) and loading operation is more severe than the hauling process. Reducing the stress involved with each step in the process is important because the effects of the individual stressors are cumulative and the total effect may reduce long term survival.

ONTARIO MINISTRIES OF THE ENVIRONMENT AND NATURAL RESOURCES. 1993. Inland lake trout management in southeastern Ontario. Queen's Printer for Ontario. Kemptville, Ontario. 160 p.

The stocking of lake trout has been a traditional management approach in southeastern Ontario for many years and is often regarded as a "cure-all" solution for impaired lake trout populations. However this management technique offers only minimal benefit to the overall lake trout management program and under certain circumstances may damage reproducing lake trout populations.

As natural reproducing lake trout stocks decline due to overharvest or environmental degradation, fish stocking may improve fishing success. This results in the illusion that the natural system is not impaired; whereas the original population may have seriously declined or disappeared gradually through the years.

Lake trout stocking also appears to add harvest pressure. Many anglers are attracted to stocked lakes believing that the fishing will be better because of the stocking activity. Since angling is non selective, removing both native and stocked fish, any harvest pressure added because of stocking places additional harvest pressure on the native fish stocks often at a time when they cannot sustain additional stress because of existing overharvest situations.

There is concern with respect to the genetic effect of hatchery lake trout surviving to reproduce and mix with native lake trout. Recent evidence suggests that native stocks are best suited for the specific habitat in which they live. On the other hand, hatchery-reared fish may possess a very different genetic make up. Mixing genetically dissimilar types of lake trout can results in degradation of the native gene pool which may seriously jeopardize the survival value of the resulting progeny.

The emphasis on stocking lake trout lakes having significant natural reproduction has been evaluated, taking into consideration concerns about added harvest pressure, the non selective nature of harvest and the potential impacts of genetic inbreeding. As a result of the evaluation, the primary role of lake trout stocking will be to supply artificial angling opportunities in holding basin lake trout lakes with good potential for rehabilitation. Stocking lake trout lakes with significant natural reproduction will be de-emphasized and, as native lake trout populations recover in response to other management actions, lakes with significant natural reproduction will receive progressively less stocking.

ORENDORFF, J. A. and N. C. FRASER. 1984. Stocking of salmonids in inland lakes: A summary for Algonquin Region, 1974-1983. Provincial Fish Stocking Assessment Program Report 84-3. Fish Culture Section. Ontario Ministry of Natural Resources. Toronto, Ontario. 43 p.

Fish stocking information from 1974 to 1983 was collated for a number of species including lake trout. Overall, in terms of the total numbers of fish stocked, lake trout outnumbered all other species stocked but were lowest in terms of the density of fish stocked at 0.2 kg/ha. Lake trout stocked lakes had the greatest mean area (391 ha) and mean depth (11.4 m).

OSTERGAARD, D. A. 1982. Retention of coded wire tags in lake trout. Progressive Fish Culturist 44 : 162.

Beginning in October 1979 and continuing through October 1981, personnel at the Allegheny National Fish Hatchery, Warren, Pennsylvania have tagged 1,769,170 fingerling lake trout with the binary coded wire nose tags. During this marking effort, tag retention at the hatchery has been closely monitored.

The retention of coded wire tags in 193,490 fall fingerling lake trout of the 1979 year class (9.6-10.2 cm long) was 90% for 4,000 fish sampled 4 days after being tagged. In 509,315 yearling lake trout of the 1979 year class (14.4-15.2 cm long) tag retention was 96% for 4,0-00 fish sampled 95 to 182 days after tagging. Tag retention in 181,705 fall fingerling lake trout of the 1980 year class (10.6-11.1 cm long) held for 8 days after tagging was 97% for the 3,000 fish sampled. In 772,510 yearling lake trout of the 1980 year class (15.4-16.7 cm long) tag retention was 98% for 9,500 fish sampled 76 to 130 days after tagging. Tag retention in 112,150 fall fingerling lake trout of the 1981 year class (11.1-11.8 cm long) held for 6 days after tagging was 98% for the 3,000 fish sampled.

Improvements in head mold design and tagging techniques over the two years of the program have resulted in a total increase of about 8% in retention of tags.

OVERHOLT, J. E. 1977. 1977 Charleston Lake winter creel census. File Report. Ontario Ministry of Natural Resources. Brockville, Ontario.

One hundred and eighty-seven anglers were interviewed during March 1977. These anglers exerted 1170.5 angler hours with a lake trout catch of 132 fish for a catch-per-unit-of-effort of 0.113. Of 120 trout whose origin was determined, hatchery-reared fish accounted for 55% (66 fish).

PAINE, M. D. 1986$_a$. Quality measures for lake trout and its hybrids: Review and recommendations. Fish Culture Section, Ontario Ministry of Natural Resources. Toronto, Ontario.

The quality of hatchery fish is one factor which may influence post-stocking survival. In this report procedures for sampling and measuring quality in lake trout and its hybrids are provided. Quality measures include size, growth, condition factor, fin and gill condition indices and fin clipping quality.

PAINE, M. D. 1986$_b$. Ontario Ministry of Natural Resources lake trout stocks: Characteristics and status of the stocks and their source waters. Fish Culture Section, Ontario Ministry of Natural Resources. Toronto, Ontario. 15 + p.

The Ontario Ministry of Natural Resources (OMNR) currently uses lake trout from six locations to provide brood stocks and young trout for stocking. There are two sites in Lake Superior (Slate Island and Michipicoten Island), two in Lake Huron (Parry or Big Sound, Iroquois Bay MacGregor Bay) and two inland lakes (Killala Lake and Lake Manitou). In this report known data on the physical and chemical characteristics of these sites are summarized and available information on the resident lake trout stocks reviewed. We do not known if the behavioural, morphological and demographic characteristics of current stocks are suitable and are diverse enough for OMNR needs. We also do not know which stocks perform best after stocking; there are differences in size, age at maturity, egg size and size of hatchery-reared yearlings which may influence post-stocking success.

PALILIONIS, A. P. 1978$_a$. Buck Lake creel census report, 1978. File Report. Ontario Ministry of Natural Resources. Napanee, Ontario. 28 p.

A summer creel census program was carried out during May, June and July of 1978. During this creel period, 380 anglers were censused and 82 game fish sampled. The estimated monthly fishing efforts for the months of May, June and July were 4,530, 3875 and 10,895 man hours, respectively. Of the 82 gamefish sampled, 44% were largemouth bass, 17% northern pike and 6% lake trout. With only 5 lake trout sampled during the creel period, there is not enough data to make any decisions about the trout population of Buck Lake. For some reason, lake trout anglers prefer to remain off the lake during the summer period and exert effort during the winter season. With the increased pressure and harvest during the winter, fin clipped fish are more evident. During the winter fisheries of 1975 and 1977, 23.7% and 22% of the harvest consisted of fin clipped (stocked) lake trout.

PALILIONIS, A. P. 1978$_b$. Devil Lake creel census report, 1978. File Report. Ontario Ministry of Natural Resources. Napanee, Ontario.

A creel program was carried out on Devil Lake during the months of May, June, and July of 1978. Total monthly efforts for May, June and July were estimated as being 5,387, 5,742 and 13,553 man-hours during which time the estimated harvest amounted to 3,813 gamefish. Of these 39.5% were lake trout, 28.7% largemouth bass, 24.8% smallmouth bass and 7% northern pike.

The CUE for lake trout for the creel period was 0.095 with a high of 0.149 occurring during the latter half of June. The CUE for all gamefish rose throughout the summer from a low of 0.07 to a high of 0.211. The CUE for the summer was 0.142.

The lake trout population shows signs of stress, with a high percentage of the harvest being small, immature fish. However, the stocking program does not appear to be contributing to the fishery.

The total known harvest of all fish from Devil Lake is 8,068.42 lbs. Several months of the fishing season have been excluded from this estimate.

PALILIONIS, A. P. 1979. Lake trout winter fishery, March 1979. File Report. Ontario Ministry of Natural Resources. Napanee, Ontario.

A creel census program was conducted on a set of lake trout lakes during the 1979 March fishing season. Devil Lake, Big Salmon Lake, Knowlton Lake and Desert Lake had the largest lake trout caught. These same lakes had low fin clip returns between 10 and 17%. Little Salmon Lake had the highest return of fin clips with 65%. This lake was established as an artificial put-and-delayed-take fishery in 1968. Although it is doubtful that natural reproduction has occurred (the occurrence of unclipped fish more than likely represents unmarked hatchery fish from the stocking program several years ago) it is an encouraging sign for an artificial situation. Gould and Buck lakes followed with fin clip returns of 46 and 33% respectively. The latter lake is considered as having water quality at the threshold of lake trout tolerance. Fishing pressure on Buck Lake is high but no higher than other lakes so that a reduction in reproductive success may be responsible for this high fin clip return.

Our data indicate that stocked fish enter the fishery as early as age 2 (although at a very low incidence) and remain in the fishery until 10 years of age. The highest proportion of the stocked fish are removed at ages 4-6.

PATRICK, N. D. 1960. Hill's Lake Hatchery experiment and supplement: Fish transportation methods. File Report. Ontario Department of Lands and Forests. Kirkland Lake, Ontario. 2 p.

Experimental work on fish shipping methods is continuing at Hill's Lake Hatchery, and this report covers an attempt to increase truck capacity by using a buffer to stabilize water acidity. The experiment was a failure because the fish were not crowded enough in spite of the fact that some tanks were carrying well over twice the "normal" load. It is obvious that our present truck shipment method (at least from Hill's Lake) is inefficient and requires study.

PATRICK, N. D. 1965. Annual report of fish plantings in Tweed District. File Report. Ontario Department of Lands and Forests. Tweed, Ontario. 17 p.

The 1965 lake trout stocking program in the Tweed District consisted of releasing 15,000 fish in 14 lakes in Hastings County, 4,500 fish in 5 lakes of Lennox-Addington County, 42,000 fish in 25 Frontenac County lakes and 9,500 fish in 10 Prince Edward County lakes.

Based on volunteer angler returns from the 1964 fishing season, anglers fished 41 lakes containing lake trout. Based on returns for 2151 fishing trips, 1833 lake trout were caught for an average of 0.85 trout per trip.

PELLEGRINI, M. 1992. Lake trout stocking assessment on Wawa Lake. File Report. Ontario Ministry of Natural Resources. Wawa, Ontario.

Wawa Lake has been planted with lake trout on a regular basis since 1952. Between 1951 and 1989, a total of 23,000 fry, 6,000 fingerlings, 223,787 yearlings, 1,800 two year olds and 400 three year old lake trout have been stocked.

The largest single stocking was 41,800 yearlings in 1989 which represented a stocking density of 61.7 fish ha^{-1}. The stocking rate from 1971-1988 had ranged from 6.6-15.8 fish ha^{-1}. This large planting of lake trout in 1989 was designed to see if the potential problem of smelt predation could be overcome.

Stocking assessment has been conducted by the use of gill netting. Netting was conducted in 1980, 1981, 1982, 1983, 1989, 1990 and 1991. Results of those projects may be summarized as follows:

Catch	1980	1981	1982	1983	1989	1990	1991
All lake trout	58	98	98	63	76	101	181
Native lake trout	51	79	76	45	66	86	179
Stocked lake trout	7 (12.1%)	19 (19.4%)	22 (22.4%)	18 (28.6%)	10 (13.2%)	15 (14.8%)	2 (1.1%)
L. Whitefish	489	455	321	307	202	149	166
L. Herring	133	148	113	42	27	34	24

..cont'd

Catch	1980	1981	1982	1983	1989	1990	1991
A. Smelt	37	203	130	17	202	69	43
Burbot	38	5	1	7	14	18	35

Although the proportion of stocked trout was significant between 1980 and 1983, we did not know if stocked fish were merely displacing fish that would have survived from natural reproduction. Assessment netting in 1989, 1990 and 1991 failed to recover any of the fish planted in 1989. Stocking through the ice is certainly a suspect cause of the poor survival for the 1989 plant but we have no way of knowing for certain. The increased abundance of native lake trout may indicate better survival of native trout from previous years.

Based on these results we stopped stocking Wawa Lake with lake trout after 1989. No quantified assessment work has been done since 1991 however anecdotal information suggests that the fishery is as good as it ever was and may, in fact, be better.

PENMAN, D. J. and B. J. McANDREW. 1997. Practical aspects of selection and fitness of stocked fish. p. 223-234. *In* T. Petr [ed.]. Inland Fisheries Enhancements. FAO Technical Paper 374. Rome Italy.

This paper concentrates mostly on genetic events occurring within hatcheries which have relevance to the production of fish for stocking as part of enhancement programs. However, it should be recognized that stocking from hatcheries is not a substitute for habitat restoration or reduction in fishing intensity where the objective is to conserve natural populations. The objectives of fishery enhancement by stocking vary, for example from the conservation of genetically pristine populations in open waters at one extreme to maximization of food production in artificial waters. Historically, the major challenge facing hatcheries producing many freshwater species has been to meet the quantitative demands for fry and fingerlings: in many cases, little or no attention has been paid to genetic management of the stocks within hatcheries. It should be recognized that a lack of active genetic management of hatchery stocks does not mean that no change will take place within such stocks: on the contrary, processes such as founder effects, bottlenecks, inbreeding, domestication and negative selection may occur with negative effects on fitness-related traits such as growth and survival. Active genetic management of hatchery stocks may be used to minimize genetic changes or to select for improved performance of such stocks. To date there have been few examples of selective breeding for improved performance of fish for fishery enhancement purposes but possibilities for this are discussed. Techniques which may be used to assist in quality control of fish destined for stocking are also discussed.

PERRON, D. A. 1984. A study of lake trout spawning activity and spawning habitat in Gilles Lake, 1984. File Report. Ontario Ministry of Natural Resources. Owen Sound, Ontario. 24 p. + appendices.

The objectives of this study were to (i) document potential and actual spawning areas, and (ii) record characteristics of the resident lake trout spawning population of Gillies Lake. Daily water temperatures were recorded from October 1 to November 13, 1983. Investigative work for documentation and evening observations of potential lake trout spawning shoals commenced on October 18 and terminated on November 1, 1983.

A total of 11 potential and actual lake trout spawning shoals were documented and mapped during the study. Only 6 (54.5%) of the eleven shoals documented were actually utilized by spawners during the study period.

Nine hundred and thirty-seven (937) fish (6 different species) were captured during the study period. Of this total only 21 (2.2%) were lake trout. Only two of the fourteen lake trout sampled (14.2%) were hatchery-reared fish (both males). Based on their fin clips, stocking records indicate that these fish were 10 and 12 years old, respectively.

PLOSILA, D. S. 1970. Progress report on lake trout strain study in northern New York. New York Fish News No. 33. Bureau of Fisheries, New York State Department of Environmental Conservation. Albany, New York. 2 p.

A lake trout strain study is being conducted to determine the relative survival and growth of Upper Saranac Lake and Seneca Lake strain of lake trout and the relative survival of each strain of lake trout as it may be affected by size and/or age of fish at planting. Over 400,000 fin clipped Upper Saranac and Seneca lake strain lake trout have been planted in nine northern New York lakes during the years 1964-1968. Planted lake trout have been sampled with a standardized gill net gang consisting of three sinking type gill nets.

The Upper Saranac Lake strain of lake trout has been predominant in recoveries of planted fish made to date. The combined total recovery ratio for all nine lakes is 16.1 Saranacs: 1 Seneca. Recoveries of plants by year class is fairly equally divided between 1964, 1966 and 1967 year classes. Returns from fall fingerling plantings of both strains have in general been very disappointing as a total of only 15 Upper Saranacs and 1 Seneca have been recovered from the nine lakes. Combined findings from all study lakes show that spring fingerling plantings have produced the highest returns. Regardless of strain, recoveries have been about 2:1 in favor of spring yearling lake trout plantings.

PLOSILA, D.S. 1971. Trout: Ecological relationships: Relationships of strain and size at planting to the relative survival of lake trout. Project Report No. F-22-R-8, Job No. B-1. New York State Division of Fish and Game. Albany, New York. 33 p.

Marked spring yearling lake trout were stocked during May in nine Adirondack lakes selected for evaluating the relative survival of Upper Saranac Lake and Seneca Lake strains of lake trout. Fall yearlings (1.5 years old) and fingerlings were stocked in September. Each of the nine lakes was netted with standardized gill nets after stocking both in the spring and fall, 1966. A total of 344 lake trout were captured by all types of gear in these lakes during 1965 and 1966. Nearly 60% (201 fish) of the overall catch was tagged and released following capture.

Fourteen marked lake trout stocked during the study have been recaptured. Ten of these fish were recovered in standard gill nets and ranged from 7.2 to 12.5 inches total length. Time from stocking to recovery of these fish ranged from less than a month to 1.5 years. Twenty-seven lake trout (10.6-25.9 inches TL) from earlier stockings of marked fall fingerlings were recovered 2.5 to 6 years after stocking.

A total of 106 young lake trout were found in the stomachs of older lake trout, yellow perch, northern pike and rainbow trout collected during 1965 and 1966. Thirty-five of the young lake trout were clearly of hatchery origin and could be identified to strain and age group.

Chemical determinations made during 1966 indicate that the lakes may be divided into three groups based upon water hardness.

PLOSILA, D. S. 1977$_a$. Relationship of strain and size at stocking to survival of lake trout in Adirondack lakes. New York Fish and Game Journal 24(1) : 1-24.

Experimental stockings of over 206,000 Seneca Lake strain and over 209,000 Upper Saranac Lake strain lake trout were made in nine lakes in northeastern New York from 1964 to 1968. They comprised fall fingerlings, spring yearlings and fall yearlings and were fin-clipped to identify the strain and age at stocking. Recoveries of marked fish obtained by gill netting, trap netting, angling and pond reclamation were used to measure survival. A total of 1,812 lake trout from these lakes were examined from 1965 to 1973 among which were 495 that had been stocked for this study. The Upper Saranac Lake strain comprised 94.3% (497), while the Seneca Lake strain constituted 5.7% (28) of the recoveries. Relative survival for all lakes combined was 15.9:1 in favor of the Upper Saranac Lake strain. The ratio of survival according to age at stocking (fall fingerlings : spring fingerlings : fall yearlings) for all lakes combined was 1:9.5:8.7. Considering the similar recovery rates for the two yearling groups, lower rearing costs for spring yearlings favor this age group for stocking purposes. Strain was more important than the size of the fish or the season of the year when stocking was done in determining survival. It was concluded that the Seneca Lake strain is not suitable for stocking Adirondack lakes. For lake trout stocking programs in these waters, spring yearlings of the Upper Saranac Lake strain or other Adirondack stock should be used.

PLOSILA, D. S. 1977$_b$. A lake trout management program for New York State. Bureau of Fisheries. New York State Department of Environmental Conservation. Albany, New York. 67 p.

Management of lake trout in some New York lakes requires partial to complete dependence upon annual maintenance stocking of fingerling and/or yearling hatchery-reared lake trout to sustain a viable sport fishery. New York's existing lake trout stocking program for inland waters is based upon the collection of eggs from wild stocks. Supplemental sources of lake trout from out-of-state are sometimes made available to New York when surplus stocks develop elsewhere.

Lake trout stocking priorities and allocations are honored in decreasing order of importance as follows: (1) brood stock lakes, (2) maintenance stockings in other waters, and (3) experimental stockings for research purposes.

Lake trout stockings are normally scheduled in the spring and fall months so that fingerlings and yearlings are not subjected to extremely warm water temperatures. Spot or scatter planting by airplane or boat over deep water areas is preferred to inshore plants where predation by warmwater fishes may be experienced.

Although both Adirondack and Finger Lakes stocks usually survive well following planting in large, lowland-type lakes, only Adirondack stock has been successful in Adirondack upland lakes and some peripheral waters. The reason or reasons for the poor survival of the Finger Lakes stock in these waters is unknown.

It is obvious that annual demands for the existing inland lakes stocking program and new stocking programs in border lakes will be difficult to meet with New York's present unstable egg supplies and lake trout production. Total annual demands for lake trout under current stocking policies may increase from 1,300,000 lake trout in 1975-76 to 1,500,000 lake trout by year 1980. Availability of out-of-state stocks for the Great Lakes will reduce this substantially leaving from 750,000 to 900,000 lake trout to be procured annually.

POLKINGHORNE, D. 1983. Whitepine Lake (McLeod Township): Comparative lakes study assessment, 1982 and 1983. File Report. Ontario Ministry of Natural Resources. Sudbury, Ontario. 14 p. + appendices.

Once considered an excellent lake trout lake, Whitepine Lake's lake trout fishery declined in the late 1960s due to acidification and overharvest. A 1978 survey indicated that Whitepine Lake had the symptoms of a fishery suffering from acidification: a lake trout population consisting of only a few large individuals that were failing to reproduce and an abundance of the acid-tolerant yellow perch.

On November 6, 1980, the lake was stocked with 790 yearling (adipose fin clipped) lake trout from the Tarentorous Hatchery in Sault Ste. Marie. On May 12, 1981, 784 2+ year old lake trout (also fin clipped) were stocked. In the fall of 1982, sixteen adult lake trout were transferred from nearby Regan Lake into Whitepine Lake to supplement the tiny brood stock of native fish.

In October, 1983, Whitepine native trout, Regan Lake adults and the stocked trout males were all observed engaging in spawning activities. Egg deposition was confirmed by SCUBA divers.

The lake trout population of Whitepine Lake presently consists of a few large, old, native adults, several Regan Lake adults, the remaining stocked adipose clipped trout and a number of small, unclipped trout that are apparently the product of successful spawnings in 1981 and 1982. These latter trout are the first indication that the species is making a natural comeback in the lake.

POPOV, B. H. and J. B. LOW. 1953. Game fur and fish introduced into Utah. Miscellaneous Publication No. 4. Utah State Department of Fish and Game. Salt Lake City, Utah.

The first introduction of lake trout to the state of Utah occurred in 1894 when 100,000 lake trout eggs were received from Michigan and the resulting fry were planted in Utah Lake. The results of this introduction are unknown. Subsequent introductions involving fry were made to several waters in 1900, 1901 and 1905. By 1905 reports from Fish Lake, first stocked in 1900, indicated that the lake trout were doing well there. By 1906, no favorable reports had been received from the Utah Lake plants.

At the present time, the lake trout is known to be in only three locations in Utah: Fish Lake, Bear Lake and Mary's Lake at the head of Big Cottonwood Canyon.

POWELL, M. J., M.-F. BERNIER, S. J. KERR, G. LEERING, M. MILLER, W. SAMIS and M. PELLEGRINI. 1986. Returns of hatchery-reared lake trout from eight lakes in northeastern Ontario. Ontario Fisheries Technical Report Series No. 22. Ontario Ministry of Natural Resources. Toronto, Ontario. 7 p.

Eight lakes in northeastern Ontario were stocked with 16 month old lake trout (18.6-24.3 g) in 1977, 1979, 1980 and 1981. The contribution of hatchery lake trout to the size of the naturally produced year classes, as assessed by gill nets from 1980 to 1983, ranged from 1% in Net Lake to 92% in Shakwa Lake. In four of the lakes, the stocked fish outnumbered the native fish in the year classes considered. The survival of the hatchery fish seemed to be negatively influenced by both the size of the native lake trout population in the lake and the size of the whitefish and cisco populations.

POYNTER, R. M. 1976. Fecundity of hatchery-reared lake trout in relation to food availability. p. 78. *In* American Fisheries Society 106th Annual Meeting, Dearborn, Michigan (Abstract only).

The fecundity of hatchery-reared lake trout appears to be related to food availability. Fish fed at a daily rate equal to 0.75% of their body weight, produced more eggs per fish and these eggs were larger and fertility was greater when compared with eggs from fish fed at a daily rate of 0.5% of their body weight.

PRYDIE, C. 1991. Experimental management and stocking assessment on four lake trout lakes with over-abundant lake herring populations, 1987-1989. File Report. Ontario Ministry of Natural Resources. Espanola, Ontario.

In 1987 and 1989, an assessment of the lake trout and lake herring populations in Bellows, Kecil, Kindle and Whiskey lakes was conducted in response to complaints of poor lake trout returns to anglers. Ten overnight gill net sets were carried out in 1987 and repeated in 1989: 2 in each of Bellows, Kecil and Kindle lakes and 4 in Whiskey Lake.

Prior to the 1987 assessment all four lakes had been stocked on an annual basis. With poor returns of lake trout in the 1987 assessment several adjustments were made to the stocking procedures for all four lakes. Bellows Lake, which had traditionally been stocked with approximately 4,000 lake trout/year was stocked with 4,000 F_1 splake in 1987 and 2,000 F_1 splake in 1988. Splake were chosen as an alternative to lake trout in the hopes that this species could compete with the lake herring population in the lake where lake trout had been unsuccessful. In the past, lake trout stocked in the four study lakes had been reared in provincial hatcheries and weighed an average of 18 gm at the time of stocking. As the 1987 survey indicated that these fish were unable to compete with the herring in the lakes, larger lake trout (159.6 gm) reared at the cage culture operation in Swift Current and larger F_1 splake (138.3 gm) reared in a provincial fish hatchery were stocked in 1987. Whiskey Lake was stocked with 10,000 fish in 1987 and 683 fish in 1988. Kindle Lake received 8,000 fish in 1987 (twice the planned number as the 4,000 fish for Kecil Lake were mistakenly stocked in Kindle lake). As a result, no fish were stocked in Kecil Lake in 1987. In 1988, Kecil Lake received 5,100 lake trout while Kindle lake was not stocked.

The data collected from lake trout caught during the stocking assessments (29 in 1987 and 12 in 1989) does not provide a sufficient database to draw any significant trends or conclusions. Of the fish stocked in 1987 and 1988, only one lake trout and three splake showed up in the catch. The sole lake trout captured in 1989 was caught in Kecil Lake and weighed 150.0 gm at the time.

With the lack of lake trout data, it is difficult to determine whether the stocking or larger fish gave the lake trout any advantage on the herring in the lakes. Assuming that the decrease in the abundance of lake herring (based on netting CUE) in the lakes was indeed a result of the stocking of the larger fish, it is still not clear that the lake trout have benefited from this decrease.

The four study lakes were not stocked in 1989 to allow time to evaluate the effectiveness of the stocking changes. The lakes were stocked in 1990; however the larger lake trout and F_1 splake used for the 1987 and 1988 stocking were no longer available. The lakes should be assessed again in 1991 to ensure that any trends in either the lake trout or herring population are directly related to the changes in the stocking program and not just a fluctuation in year class strength.

PURYCH, N. A. 1973. The 1968-1972 lake trout sport fishery of Jimchrist Lake. File Report. Ontario Ministry of Natural Resources. Blind River, Ontario. 34 p.

Creel census data are presented for the fishing seasons 1968-1972 on Jimchrist Lake. Catch statistics, age, sex, size and weight composition, state of maturity and stomach contents were analyzed. The contribution of four plants of hatchery-reared lake trout (6,000 yearlings in 1964, 1965 and 1966; 1,280 two year old fish in 1969) was also determined.

Fishing pressure fluctuated considerably between 1968 and 1972 with a high of 1,493.5 man-hours in 1970 and a low of 647.7 man-hours in 1969. The 5-year average was 992.7 man-hours. Shore fishing contributed a majority of the fishing pressure. CUE was highest in 1969 (0.513) and lowest in 1972 (0.078). The 5-year average was 0.241 fish per man-hour. Harvest in 1968 was 74 fish, increasing in 1969 and 1970 to 316 and 623 fish, respectively, then decreasing in 1971 and 1972 to 106 and 73 fish, respectively. Both effort and harvest were heavily concentrated in the month of May. The annual estimated yield (pounds per acre) was consistently high giving a 5-year average of about 1.5 pounds per acre. Fishing quality was highest in 1969, closely followed by 1970. Quality was much lower in 1972, 1968, and 1971.

Lake trout age V dominated the catch over the 5-year period but few IV or V year old fish have been caught since 1970. The 1964 and 1965 year classes were the most abundant year classes in the fishery during the 5 years of census.

The ratio of males to females was 56.6:43.4. The youngest mature male was age IV and females did not mature until age VI. All males and females age VII and older were mature. Maturity was first observed for males at 16 inches in total length and for females at 16.5 inches. All males over 19.2 inches and all females over 19 inches were designated as mature.

Mayfly nymphs were the most important food item as they occurred in 55% of the sampled fish. Two parasite species were identified, the tapeworm (*Eubothrium salvelini*) and the roundworm (*Cystidiola cristivomeri*).

Total lengths ranged from 10.7 inches to 23.4 inches and round weights ranged from 0.2 to 4.4 pounds. The average total length of lake trout caught was 15.4 inches and the average weight was 1.1 pounds. Lake trout in the 15-inch class and weighing less than 1 pound were dominant in the catch. The contribution of fish over 2 pounds totaled only 11.6%.

The contribution of hatchery-reared lake trout has been negligible. Only 1.4% of the fish examined were fin-clipped. The total estimated catch of all four plants was 18 fish or 0.25% of the 7,280 fish stocked.

On the basis of results it is recommended that winter closure be continued, that lake trout stocking be discontinued, and that use of outboard motors be prohibited.

PURYCH, P. R. 1970. The 1970 Basswood Lake creel census report with a comparison of the 1967-70 lake trout fishery. File Report. Ontario Ministry of Natural Resources. Blind River, Ontario. 30 p. + appendices.

The fourth year of the Basswood Lake study was completed in 1970. During the 1970 census, 59.4% of the people observed on the lake during the period May to August inclusive were lake trout anglers as compared to 62.8% in 1967, 45.2% in 1968 and 51.5% in 1969. An estimated 2,148 angler days produced 7,171.7 man-hours of effort to harvest an estimated 766 lake trout. The fishing intensity was 1.07 man-hours of effort per surface acre. The season average for the rate of success was 0.106 fish per man-hour. The estimated harvest of 1,696.0 pounds represented a yield of 0.254 pounds per acre. Fishermen average 0.43 lake trout per person per complete trip and 4.5 % of the anglers intèrviewed reported catching their limit of three fish.

The general trend of the lake trout fishery from 1967 to 1969 was an increasing success rate and a decreasing fishing pressure. However, in 1970 the fishing pressure increased 42.9% over the 1969 pressure. The CUE decreased 28.3% in 1970 from that in 1969 and the harvest remained roughly the same.

A total of 1,208 five year old tagged lake trout were planted in Basswood Lake in November, 1968. The lake trout averaged 11.9 inches total length and 7.6 ounces in weight when tagged. In 1969, 29 lake trout of the 1968 plant were reported caught and 2 tagged lake trout were caught in 1970. The total number of known recaptures from the 1968 plant through 1970 was 31 fish or 2.6%. The return from the shore plant (22 of 611 fish) was 3.6% and the average return from the 3 open water plants (9 of 597 fish) was 1.5%. Two tags from the April 1969 plants of 2,099 fish (1,495 tagged) were found in the stomach of a lake trout in June of 1969. No fish from the 1969 plant were reported caught in 1970.

PURYCH, P. R. 1973. The 1971 Basswood Lake creel census report. Ontario Ministry of Natural Resources. Blind River, Ontario. 20 p. + appendices.

The fifth year of the Basswood Lake study was completed in 1971. During the 1971 census, 56.8% of the people observed on the lake during the period May 5 to September 12 inclusive were lake trout anglers. Of the 523 lake trout anglers interviewed, 61.8% were Ontario residents. Citizens of the United States comprised 38.2% of the anglers. An estimated 2,860 angler days produced 7,663.6 man-hours of effort to harvest an estimated 564 lake trout. The fishing intensity was 1.15 man-hours of effort per surface acre.

The season average for the rate of success was 0.074 fish per man-hour. The estimated harvest of 1,321.5 pounds represented a yield of 0.198 pounds per acre.

No hatchery-reared lake trout were caught during the 1971 creel census. The total number of planted fish reported caught by anglers to date is 31 lake trout from the 1968 plant and none from the 1969 plant. Planted fish have not contributed significantly to the sport fishery.

PURYCH, P. R. 1975$_{a}$. Lake trout spawning investigation, Horner Lake – 1974. File Report. Ontario Ministry of Natural Resources. Blind River, Ontario. 9 p.

Lake trout were introduced into Horner Lake in 1969 with the goal of establishing a naturally reproducing lake trout population that would utilize the hypolimnion. Three additional plants (1970, 1972, 1974) have taken place since the introduction. Gill netting was conducted in the summer and fall of 1974 to determine if natural reproduction was occurring. No young, unmarked lake trout were captured to indicate that natural reproduction was occurring. Sites at which lake trout which were captured suggest that trout from the introductory plants have not dispersed evenly throughout the lake. Netting with small mesh gill nets in the summer, targeting on young, unclipped trout will be continued.

PURYCH, P. R. 1975$_{b}$. The contribution of hatchery lake trout to the Flack Lake lake trout sport fishery for the period 1968-1974. Ontario Ministry of Natural Resources. Blind River, Ontario. 8 p. + appendices.

Flack Lake, a 9.5 km^2 lake in the district of Algoma, Ontario, has been intensely studied since 1968. This report describes the contribution of hatchery-reared lake trout (*Salvelinus namaycush*) to the sport fishery. Data are presented for the period 1968-74 which indicate the contribution of three years of hatchery-reared lake trout plants.

A total of 15,000 yearling lake trout, marked by fin removal, were planted in 1964, 1965, and 1966. Only 11 (0.22%) of the 4,935 lake trout checked during the period 1968-74 were fin clipped. An estimated 45 hatchery-reared lake trout (0.30%) have been captured from the three plants. Of the three plants of lake trout which weighed a total of 87.09 kg, only 17.87 kg of trout have been harvested.

Reasons for the low returns are suggested and discussed in conjunction with other studies done on the survival of hatchery-reared lake trout. Management implications of the findings are discussed.

PURYCH, P. R. 1976$_{a}$. A report on the study of an introduced lake trout (*Salvelinus namaycush*) population in Horner Lake. Ontario Ministry of Natural Resources. Blind River, Ontario. 17 p. + appendices.

The Ministry of Natural Resources introduced lake trout into Horner Lake in 1969 with the goal of establishing a naturally reproducing lake trout population that would utilize the deep hypolimnetic waters of the lake. Three follow-up plants have subsequently taken place since the introduction.

The Horner Lake study (1972-1976) has disclosed that there has been a reasonably good survival and growth of the introduced lake trout. It is apparent, however, that there has been a decline in the growth rate of lake trout from each subsequent plant with a few exceptions. Small mesh gill netting in July 1976 resulted in the capture of young unclipped lake trout. This was the first documentation of successful reproduction. As the lake trout were determined to be yearlings, successful reproduction must have occurred for the first time at age 6+ in the fall of 1974. As successful reproduction has been documented it appears that the objective of this project has been met.

PURYCH, P. R. 1976$_b$. The lake trout (*Salvelinus namaycush*) fishery of Flack Lake. File Report. Ontario Ministry of Natural Resources. Blind River, Ontario. 58 p. + appendices.

The seventh year of creel census on Flack Lake was completed in 1974. Data have been analyzed to show annual changes in catch statistics for the period 1968-1974. Changes in the length, weight and age composition of the lake trout sampled have been documented along with the contribution of three years of hatchery-reared yearling lake trout plants.

The catch statistics for the total fishery (park boat and shore, lodge, island camp) revealed a seven year average fishing pressure of 6,717.0 man-hours. The average CUE and average number of lake trout harvested during the same period was 0.231 fish per man-hour and 2,076 lake trout respectively. The average yield was 1.162 pounds per surface acre since the inception of the creel census in 1968.

Lake trout age V and/or VI were the dominant age group(s) in the fishery in all years censused. Lake trout age VI and older were dominant in the catch in 1968, 1969, and 1973 whereas lake trout age V and less were dominant in all other years of the study. Age composition data combined indicate that age groups IV-VII comprised 97.5% of the catch. In every year the most important contribution of lake trout came from fish between 13.0 and 19.9 inches in total length. Lake trout within this size range comprised between 88.0% and 97.5% of the observed catch each year. Lake trout in the 16-inch size group were dominant in all years except 1970 and 1971 and lake trout in the 1.0-1.4 pound class comprised the dominant group of fish sampled in all years except 1970.

The contribution of hatchery-reared lake trout to the sport fishery of Flack Lake would have to be considered negligible as only 0.22% of all the lake trout checked during the creel census were of hatchery origin. An estimated 45 hatchery-reared lake trout appeared in the anglers' creel which is 0.30% return of the 15,000 yearlings planted.

A high exploitation rate (40.6%) as indicated by creel census data suggests that there is an intensive fishery for lake trout. Certain changes observed in the lake trout population such as an increased growth rate, reduced age of sexual maturation and an increased vulnerability to angling of younger lake trout are suspected to be attributable to the effects of the high exploitation rate.

The results are discussed in relation to studies done on other lake trout populations. Recommendations are made with the goal of maintaining and/or improving the quality of lake trout angling.

PURYCH, P. R. 1977$_a$. A case against stocking. Ontario Fish and Wildlife Review 16(2) : 3-5.

Flack Lake has been known for its high quality lake trout fishery since the 1920s. On a trial basis, 5,000 yearling lake trout were planted annually in Flack Lake in 1964, 1965 and 1966. These fish, distinguished by the removal of a different fin each year, came from the provincial hatchery in Sault Ste. Marie. To determine the contribution of the stocked fish to the anglers creel, an intensive creel study was carried out during every fishing season since 1968.

Of the 4,935 lake trout examined during the 1968-74 period, only 11 had clipped fins and fin regeneration was not considered to be a problem. Of the 15,000 lake trout planted it was estimated that anglers caught only 45 or well below 1% of the planted fish.

The failure of hatchery lake trout in Flack Lake is likely due to predation and competition from the native population. Natural reproduction and recruitment appear to be sufficient to meet the carrying capacity of the lake. In other words, the native lake trout seem to be maintaining sufficiently high numbers to squeeze out the less well adapted hatchery fish. It is apparent that fishery managers should think twice before planting lake trout in lakes where natural populations are sustaining themselves in spite of fishing pressure.

PURYCH, P. R. 1977$_b$. Poor returns of hatchery-reared lake trout to the sport fishery of Flack Lake, Ontario, 1968-74. Progressive Fish Culturist 39(4) : 185-186.

Returns of hatchery-reared lake trout (*Salvelinus namaycush*) to the sport fishery in 9.5 km^2 Flack lake in 1968-74 were extremely poor. A total of 15,000 yearling lake trout that were marked by fin removal and planted in 1964-66, only 11 (0.22%) were observed during a creel census in 1968-74 and only 45 hatchery-reared lake trout (0.30%) were estimated to have been recovered during the period. Less than 18 kg of trout were harvested from three plantings that weighed a total of 87.1 kg.

PURYCH, P. R. 1980. Successful reproduction of introduced lake trout in Horner Lake, Ontario. Progressive Fish Culturist 42(3) : 163-164.

Lake trout were introduced to Horner Lake in 1969 with the goal of establishing a naturally reproducing population. An overall total of 20,000 yearling lake trout were planted in 1969, 1970, 1972 and 1974. The stocking rate was about 12 fish/ha. Gill netting was conducted in October 1972, November 1973, July and October 1974, August and October 1975, and July and October 1976. From 1972-1975, 110 fin clipped lake trout were captured; in 1976 42 fin clipped and 31 unclipped trout were collected. Partial regeneration of 42.8% of the clipped fins caused no difficulty in identifying the hatchery-reared fish. Since successful reproduction has been documented the objective of establishing a naturally reproducing lake trout population in Horner Lake appears to have been met.

QUÉBEC MINISTÈRE DU LOISIR, DE LA CHASSE ET DE LA PÊCHE. 1988. Technical guidelines for introducing and restocking lake trout. *In* Stocking Guidelines for Fish Species Other Than Atlantic Salmon. Direction de la gestion des espèces et des habitats. Québec City, Québec. 79 p.

Guidelines for stocking or transferring lake trout in Québec waters may be summarized as follows:

- Introductions of lake trout where a population of brook charr or freshwater red charr is found is not recommended.
- Stocking is to be carried out with yearlings, corresponding approximately to 44 fish/kg. In cases where there is a surplus in fingerling production they are to be stocked at a rate 10 times greater than that prescribed for yearlings. The maximum quantity per project is 25,000 age 1+ fish. For all plantings a minimum quantity corresponding to 75% of the rates prescribed below is mandatory.
- Stocking rates apply to areas of suitable habitat, that is, where the summer water temperature is below 12° C and dissolved oxygen concentrations are greater than 5 ppm. The following stocking rates are the maximum permitted:

		Ecological Region			
		Sedimentary		Precambrian Shield	
Objective	Fish Community	< 400 ha	> 400 ha	< 400 ha	> 400 ha
Introduction	Coldwater	24/ha	12/ha	20/ha	10/ha
Introduction	Warm/coolwater	16/ha	8/ha	12/ha	6/ha
Put-grow-take	Coldwater	8/ha	4/ha	7/ha	4/ha
Put-grow-take	Warm/coolwater	5/ha	3/ha	4/ha	2/ha
Rehabilitation	Coldwater	12/ha	6/ha	10/ha	5/ha
Rehabilitation	Warm/coolwater	8/ha	4/ha	6/ha	3/ha

- Strains from similar ecological regions are to be used.
- Stocking is to be conducted on an alternate year basis with most projects having a duration of five years.
- The stocking period is relative to the life stage being planted. Stocking is carried out according to the temperature of the receiving waters, preferably between 4 and 10° C on the surface but never above 15° C.
- Trout should be uniformly distributed over deep water.
- The success of this stocking technique must be assessed in the fourth year of the project. Fin clipping, using only the adipose and/or pectoral fins, or micro tags can be used to mark fish.

RAINE, G. 1970. 1969-70 winter fishing report, Kemptville District. File Report. Ontario Department of Lands and Forests. Kemptville, Ontario.

During the winter of 1969-70, a general winter creel census program was conducted on a number of waters located in the Kemptville District. Four of these waters (Charleston, Napier, Rideau and Red Horse lakes) provide lake trout fisheries which are supplemented by stocking.

On Charleston Lake, 145 anglers were checked. They reported 445 hours of fishing effort to catch 198 lake trout. One hundred and forty-five trout had fin clips (3 different fin clips in catch) indicative of their hatchery origin. Fifty-three lake trout (26.8% of the catch) had no fin clips and were assumed to be wild fish.

On Rideau Lake a total of 208 anglers reported an effort of 1051 rod hours to catch 161 lake trout. Of the lake trout catch, ten lake trout had a right pectoral fin clip (year class unknown) and one lake trout had an adipose fin clip (stocked in 1968). The remainder of the trout (93.2%) had no fin clip.

A total of 69 anglers were interviewed on Napier Lake. These anglers exerted 181 rod hours of effort to catch 25 lake trout and 6 brook trout. Five lake trout had a left ventral fin clip (stocked in 1969) and one fish had an adipose fin clip (stocked in 1968).

One hundred and twenty-seven anglers were contacted on Red Horse Lake. They reported 376 rod hours of effort and a catch of 194 lake trout. Of the catch, 29 fish had no clips, 160 had a right ventral (RV) clip (stocked in 1967) and 5 had a left ventral (LV) fin clip (stocked in 1969).

RAINE, G. 1975. Preliminary observations and review of three lake trout fisheries in Leeds County. File Report. Ontario Ministry of Natural Resources. Brockville, Ontario. 16 p.

A winter creel census was conducted on Charleston, Red Horse and Big Rideau lakes from March 8 to April 4, 1975. All three lakes support popular lake trout fisheries.

On Charleston Lake, it was found that winter angling for lake trout was approximately 2.5 times as successful as during the summer months. A greater percentage of lake trout caught in the winter months were fin clipped (stocked) than those taken during the summer months. Charleston Lake trout fishing has become, to a considerable extent, a put-and-take proposition particularly during the winter.

The creel census on Red Horse Lake indicated that the winter fishery depends heavily on the lake trout stocking program to provide a put-and-delayed-take fishery.

On Big Rideau Lake, a very high percentage of lake trout caught in the winter season were fin clipped (stocked) and this percentage is greater than that found for the summer season. This winter fishery has also become virtually a put-and-delayed-take proposition.

RAWSON, D. S. 1945. The failure of rainbow trout and initial success with the introduction of lake trout in Clear Lake, Riding Mountain Park, Manitoba. Transactions of the American Fisheries Society 75 : 323-335.

In 1936, after a biological survey and a consultation of several fish-culturists, it was decided to attempt the introduction of rainbow trout (*Salmo gairdneri*) into Clear Lake. This decision was influenced by the urgent need for a suitable game fish in this lake, the chief resort in Riding Mountain Park, and by the wish to check the feasibility if rainbow trout for stocking in lakes of this life zone. Planting, in the years 1937 to 1942 was carried on according to a plan which made use of rearing ponds to increase the size of the fish released. In 1942, when it was found that the rainbow trout were not surviving, it was recommended that planting be discontinued and an attempt made to establish lake trout (*Cristivomer namaycush*). After three years of planting with adult lake trout it was found that they were surviving in the lake but as yet no evidence of spawning has been obtained. In this report the physical and biological conditions in the lake are described and discussed in relation to the fish-culture experiments. It is concluded that great difficulty will be encountered in attempting to introduce rainbow trout into lakes in which a heavy population of competitor and predator fish is already present.

RAYNER, H. J. 1940. Planting fish in lakes. Progressive Fish Culturist No. 51 (July-October) : 33-34.

A method of planting from a boat was devised to meet the need for spreading the fish over a large area during an experiment involving 4 to 10-inch lake and rainbow trout. Compartments or partitioned wells in the boat for holding the fish made planting very easy. The compartments were filled with water by removing wooden plugs in the bottom of the boat and allowing the water to flow in. A long handled dip net was used to take fish out of the compartments and place them in the lake far enough away from the boat to prevent injury by the propeller. At a speed of approximately 4 miles per hour, 9,000 fish with a total weight of 190 pounds were thus planted in two hours. By use of this apparatus, steep-side lakes where it is difficult to bring a truck to the water's edge are easily planted with fish.

READ, D. W. 1981. Creel census summary for Net, Cassels and Rabbit lakes, winters of 1975, 1976 and 1981. File Report. Ontario Ministry of Natural Resources. Temagami, Ontario.

During the winter of 1981, a lake trout stocking assessment program was initiated on Net Lake. This was a pilot study slated to continue over a six year period (1981-1986). A total of 76 lake trout were recorded but none of the trout were fin clipped. This preliminary study indicated that stocked fish were not contributing to the lake trout fishery. The as yet small size of stocked fish precluded their presence in the anglers creel.

READ, D. W., J. K. K. CHARLES and J. K. YOUNG. 1975. Herridge Lake summer creel census, summer 1974. File Report. Ontario Ministry of Natural Resources. Temagami, Ontario.

The result of thirty-three (33) creel census days of the summer fishery on Herridge lake during the 1974 season show that 214 anglers fished 443.5 hours for a catch of 66 fish consisting of 24 walleye, 11 northern pike, 11 smallmouth bass, 5 yellow perch, 1 white sucker and 1 panfish.

A total of 20,500 lake trout yearlings have been stocked in Herridge Lake since 1952 of which 2,500 were fin clipped. This stocking program has shown an insignificant contribution to the fishery. The program was curtailed in 1968.

RENAUD, B. R. 1980. The 1980 winter creel census for St. Anthony Lake, Watabeag lake and Larder Lake. File Report. Ontario Ministry of Natural Resources. Kirkland Lake, Ontario.

A creel census on three lakes (St. Anthony, Watabeag and Larder) was conducted in the winter of 1980. The number of fin clipped fish in the harvest from Watabeag Lake was 13.1%. Hatchery-reared fish comprised 18.4% of the three year old lake trout. In Larder Lake, 2.3% of the trout were fin clipped.

RIDOUT, G. 1981. Winter creel census, Sharbot Lake (west). File Report. Rideau Lakes Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Sharbot Lake, Ontario. 21 p.

Sharbot Lake supports a population of natural and stocked lake trout (*Salvelinus namaycush*). A winter creel census was conducted on the west basin of Sharbot Lake during February 1981. Data collected showed that 172 anglers fished 645 man-hours to catch 50 lake trout, resulting in a catch per unit effort of 0.078. The weight of fish harvested per hectare was 0.7 kilograms during the winter fishery.

Hatchery stocked fish are very important to the Sharbot Lake (west) fishery. These figures indicated 47.9% of the trout kept were from hatchery stock. Increase in angling pressure and reduction in total harvest from last year may indicate the necessity for more fish being stocked in future years or a change in creel limit.

ROBINSON, J. G. 1990. The response of cultured lake trout (*Salvelinus namaycush*) to stress associated with handling, confinement and transport: A comparison of hard and softwater adapted fish. B. Sc. Thesis, McMaster University. Hamilton, Ontario.

RUBIE, S. W. 1983. Spring creel census on selected lake trout lakes in the Bancroft district, May-June 1982. Fisheries Management Report 1983-03. Ontario Ministry of Natural Resources. Bancroft, Ontario.

A creel census was conducted during May and June of 1982 to assess various conditions of the lake trout fisheries of Chandos and Anstruther lakes. Although few fish were creeled for Chandos Lake, it would appear that recent trout plantings have been somewhat successful. For Anstruther Lake the opposite is apparent: no stock returns were observed from the 52 lake trout sampled.

RUPERT, J. C., B. L. GRISWOLD and R. F. CARLINE. 1980. Long term mortality of aerial stocked lake trout fingerlings. Ohio Cooperative Fisheries Research Unit, Ohio State University. Columbus, Ohio. 32 p.

SADOWSKY, J. 1998. Unnamed Lake #8 (Boyle Township) stocking assessment. File Report. Ontario Ministry of Natural Resources. Kapuskasing, Ontario. 7 p.

Unnamed Lake #8 (Boyle Township) was stocked in 1992, 1993, and 1994 with 25,000, 15,000 and 25,000 lake trout, respectively. The life stage in all years were sac fry at the swim-up stage.

Although the water chemistry and physical attributes of the lake are consistent with stocking lake trout, a later life stage is preferred when stocking (i.e. fry or yearlings). The reason for stocking this lake with swim-up sac fry was due to a surplus production at Hills Lake FCS. These eggs were to be destroyed (due to lack of facilities, funding...to rear them) if the districts did not want them. Therefore, on an experimental basis, the lake was stocked for 3 consecutive years during the late winter, at which time stocking was terminated until an assessment on survival/success could be established.

Unnamed Lake #8 was first assessed on July 28, 1994. One 400' standard lake survey net (1.5"-5.0" mesh) was used for short duration sets (2 hour approximately) in 3 locations for an effort of 9.0 hours. Only perch (12) were caught during the assessment.

Another attempt was made to catch lake trout on Sept. 3, 1998. Two 400' standard lake survey nets (1.5"-5.0") were set overnight. Net 1 was set on September 2, 1998 at 10:30 am and lifted on September 3, 1998 at 09:30 am with a netting effort of 23 hours. Net 2 was set on September 2, at 11:00 am and lifted on September 3, 1998 at 10:30 am for a netting effort of 23.5 hours. Total effort was 46.5 hours. Both nets were set between six and eight meters in depth (thermocline). Two white suckers (at approximately 0.75 kg) and 1 northern pike (approximately 8.0 kg) were caught.

It is strongly suspected that there was no survival of lake trout from the initial three years of stocking. It is recommended that stocking be conducted with lake trout yearlings (minimum size) for 1 or 2 consecutive years and reassessed for survival.

SALAR, P. 1985. Lake trout winter creel census on Bay Lake. Fisheries Management Report 1985-08. Ontario Ministry of Natural Resources. Bancroft, Ontario.

In the winter of 1984, a conservation officer checked 279 anglers on Bay Lake. The anglers fished for 846.5 person hours and caught 26 lake trout (*Salvelinus namaycush*) of which 73% were natural fish.

SAMIS, W. G. A. 1968$_a$. A winter and summer creel census on Ranger Lake, 1968. File Report. Ontario Department of Lands and Forests. Sault Ste. Marie, Ontario. 17 p.

A total of 38,000 marked lake trout yearlings were planted in Ranger Lake between 1958 and 1964. No fish from the 1958 release were observed during summer creel census studies conducted in 1959, 1960 and 1961. This was not unexpected as fish of the 1958 plant were only between 2 and 4 years of age in 1959, 1960 and 1961 and were probably not vulnerable to the summer angling gear. No hatchery fish were captured during the spawn taking operations in 1961, 1962 and 1063. Once again this was not entirely unexpected. None of the 80 lake trout captured during a 1966 lake survey on Ranger Lake were of hatchery origin. Further gill netting was carried out in 1967 but none of the 52 lake trout caught were hatchery-reared fish.

A creel census of the lake trout sport fishery on Ranger Lake was conducted during 3 winter months (January, February, March) and 3 summer months (June, July, August) in 1968. The objectives of the creel census were to assess angling activity, harvest and catch rate as well as determine the contribution of hatchery-reared lake trout to the fishery.

The estimated fishing pressure for winter and summer, as defined by the census periods, was 1,037.2 and 3,229.9 man-hours respectively. The combined value was 4,267.1 man-hours and the fishing intensity was 0.79 hours of effort per surface acre. Although fishing pressure more than tripled during the summer months the catch-per-unit-of-effort (CUE) decreased from 0.256 fish per man-hour in winter to 0.089 fish per man-hour during the summer. The estimated winter catch was 240 fish at 174.3 pounds and the summer catch was estimated at 282 fish weighing 394.8 pounds. The combined yield from the winter (0.032 lbs./acre) and summer (0.073 lbs./acre) fishery was 0.105 lbs./acre.

No fish of hatchery origin were observed during the winter and summer creel census. Lake trout caught during the winter averaged 13.4 inches in total length and 0.7 pounds in weight. Summer-caught lake trout averaged 17.3 inches and 1.4 pounds.

Age groups IV, V, and VI supported the winter fishery with 84% of the observed catch whereas the summer fishery was supported by age groups V, VI, and VII which formed 85.5% of the aged sample. The average age of winter-caught lake trout was 4.9 years compared to 6.2 years for summer-caught fish. The winter fishery was characterized by a high C. U. E. and the exploitation of smaller and younger fish than the summer fishery. Any significant increase in winter fishing would warrant additional study.

SAMIS, W. G. A. 1968$_b$. Wakomata Lake winter angling fishery, 1968. File Report. Ontario Department of Lands and Forests. Sault Ste. Marie, Ontario.

Angling activity through the ice on Sakomata Lake was checked on 22 random days during the first three months of 1968. The 91 anglers contacted caught a total of 37 lake trout (*Salvelinus namaycush*) during 460.5 man hours of fishing. The estimated total harvest was 167 fish weighing 334.0 pounds which represented a yield of 0.054 pounds per surface acre from the 6,156 acre lake.

From 1961 to 1967, 13,000 lake trout yearlings were planted in Wakomata Lake. Year classes of lake trout from 1960 to 1964, inclusive, were present in the 1968 winter sport fishery. Only one fish from the 1960 year class was examined and as the 1961 plant (1960 year class) was not fin clipped it was not possible to classify the origin of this one fish. The only other hatchery plant available to the fishery was the 1965 plant (1964 year class) but none of the 7 fish examined from this year class were fin clipped and also the 1965 plant was not fully vulnerable to winter angling. The fact that no fish from the 1966 plant (1965 year class) were present in the sample probably does not reflect on the success of the plant because of the low vulnerability and small number of fish in the sample.

SCHLESINGER, D. A. and N. G. MacLEAN. 1983. The winter sport fisheries of Big Clear, Big Rideau, Big Salmon, Charleston and Devil lakes, 1982. File Report No. 6. Rideau Lakes Fisheries Assessment Unit, Ontario Ministry of Natural Resources. Sharbot Lake, Ontario. 70 p.

A creel census was conducted on five lake trout lakes, supplemented by stocking, during the winter of 1982.

On Big Clear Lake, 134 anglers were interviewed during seven sampling days. Overall, an estimated 810 lake trout were caught of which 611 were harvested. Approximately 56% of the lake trout samples were hatchery-reared fish. Of these fish, the 1974, 1976 and 1978 year classes contributed most noticeably to the harvest. The percent return of hatchery origin lake trout for the range of year classes represented in the winter harvest was 3.36.

Two hundred and seventy-eight anglers were interviewed during seven sampling days on Big Rideau Lake. Overall, an estimated 1,832 lake trout were caught of which 1,556 were harvested. Approximately fifty-two percent of all sampled fish were of hatchery origin. Of these fish, the 1976 and 1978 year classes contributed most noticeably to the harvest. The percent return of hatchery origin lake trout for the range of year classes represented in the winter harvest was 0.89.

On Big Salmon Lake, fifty-three anglers were interviewed during seven sampling days. An estimated 265 lake trout were caught of which 258 were harvested. Sixty-two percent of all sampled fish were of hatchery origin. Of these fish, the 1975 and 1976 year classes contributed most noticeably to the harvest. The 1977 hatchery year class was again absent from the harvest. The percent return of hatchery origin lake trout for the range of year classes represented in the 1982 winter harvest was 2.24.

On Charleston Lake, 193 anglers were interviewed during seven sampling days. Overall, an estimated 3,101 lake trout were caught of which 1,668 were harvested. Forty-eight percent of all sampled trout were of hatchery origin.. Of these fish, the 1978 year class contributed most noticeably to the harvest. Unlike the previous winter season, no age II hatchery trout were sampled. The percent return of hatchery origin lake trout for the range of year classes represented in the 1982 winter harvest was 0.84.

One hundred and sixty-five anglers were interviewed during seven sampling days on Devil Lake. Overall, an estimated 886 lake trout were caught of which 545 were harvested. Only 7% of the sampled lake trout were of hatchery origin. The percent return of hatchery origin lake trout for the range of year classes represented in the 1982 winter harvest was 0.15.

Overall, during the 1982 winter open season, the percentage return of hatchery origin lake trout for the year classes represented in the harvest ranged from 0.15 to 3.36. These values are comparable to the 1.14% return for lake trout stocked as yearlings in a Maine lake. Obviously, most of the hatchery fish of any year class either die prior to recruitment or manage to avoid capture in later years. However, those hatchery fish that are harvested make up a substantial percentage of the total harvest. With the exception of Devil Lake, the percentage of hatchery fish in the total harvest ranged from 48 to 62%. Therefore, lake trout stocking programs are generally producing measurable benefits for Rideau area anglers. In the case of Devil Lake, hatchery fish made up only 7% of the total lake trout harvest during the 1982 winter season. Since the average stocking rate for the year classes represented in the harvest is not unusually low (5.67 trout/ha), increasing the stocking rate is unlikely to result in a greater lake trout harvest.

SCHRAEDER, H. A. 1983. Reproduction and subsequent exploitation of stocked lake trout (*Salvelinus namaycush*) in Cosgrove Lake, Ontario. Ontario Ministry of Natural Resources, Nipigon District.

A 1966 survey indicated that Cosgrave Lake could be suitable for lake trout establishment. It was felt that the only reason they were not already present was because of previous glacial isolation of the lake. Lake trout were first introduced in 1968 at a stocking density of about 10.2 yearlings ha^{-1}. During the fall of the same year the forage base was supplemented by the introduction of 40,000 lake herring. Subsequent stocking of lake trout was done in June 1969 (4,000 yearlings), July 1970 (1,500 yearlings), June 1971 (2,790 yearlings), October 1971 (14,920 fingerlings), May 1973 (2,000 yearlings) and June 1973 (3,900 yearlings).

An assessment of angler impact on the lake during the spring of 1971 determined that excessive exploitation of lake trout was occurring. A management recommendation for full fish sanctuary status for Cosgrave Lake was implemented during the same year. Index netting was conducted in 1973 and samples from each of the original plantings of marked fish were collected. Survival of the yearling fish up to at least age 5+ had therefore been documented.

Successful reproduction of introduced lake trout has been documented for Cosgrave lake by recruitment into the sport fishery. The results of 1979-1981 creel censuses showed that the proportion of native lake trout in the catch was increasing.

SCHULER, V. J. 1969. The lake trout population of Cayuga Lake in 1966, with special reference to changes since 1955. M. Sc. Thesis, Cornell University. Ithaca, New York.

It is apparent that the larger a trout is at stocking, the better are its chances for survival. Two year olds showed the greatest returns per thousand stocked, followed by fish age 1½ and one year old. Fish stocked as fingerlings showed the poorest return rate of all groups tried. Other researchers have reported the optimum size for returns to be 16-19 fish per pound. This is the size of yearlings stocked in Cayuga Lake in 1967. Unmarked fish of age groups II, III, IV, and V were taken but in small numbers. The contribution of natural reproduction to the population is still insignificant. Alewives and smelt were the most often found food items in trout stomachs studied.

SHEBLEY, W. H. 1917. History of the introduction of food and game fishes into the waters of California. California Fish and Game 3(1) : 3-12.

The lake trout (*Salvelinus namaycush*), known also as the salmon or mackinaw trout, was first brought to California in 1894. the shipment of 100,000 eggs was hatched at the Sisson Hatchery, with a loss of only 7%. Sixty-five thousand of the fry were planted in Lake Tahoe in May, 1895, the remainder being held in the ponds at the Sisson Station and shipped the following season. Several other lots were hatched at Sisson, and the fry deposited in the lakes of the Truckee Basin. A number of these fish are taken each season from the waters that have been stocked, where they have thrived to a considerable extent, but not as well as expected. This trout is abundant in the waters of lakes Superior, Huron, and Michigan, and should attain a large size in Lake Tahoe, as the species is adapted to cold, clear, deep lakes.

SHEEHAN, R., C. BRADY and B. CHAPPLE. 1977. Creel survey report May 17 – September 3, 1976 and January 1 – March 31, 1977. File Report. Leslie M. Frost Centre. Ontario Ministry of Natural Resources. Dorset, Ontario. 26 p.

A creel survey program was conducted from May 17-September 3, 1976 and from January 1-March 31, 1977 to provide data for the evaluation of the contribution of hatchery-reared lake trout to local fisheries.

None of the lake trout examined had any evidence of fin clips although this does not mean that all of the fish caught were naturally reproduced. Lake trout stocking records show only 47% of the fish stocked in the surveyed lakes since 1970 were fin clipped. When the difficulty in recognizing fin clips on larger fish is taken into consideration it seems safe to assume stocked fish have entered the fishery.

Lake trout stocking should be continued while spawning studies and test netting programs for stocking evaluation are carried out.

SHETTER, D. S. 1951. The effect of fin removal on fingerling lake trout (*Cristivomer namaycush*). Transactions of the American Fisheries Society 80 : 260-277.

Four lots of fish marked by fin removal were held at the State Fish Hatchery, Marquette, Michigan, to ascertain the amount of fin regeneration, comparative survival, and comparative growth which would follow this treatment over varying periods of time. It was determined that the following percentages of the surviving marked fish should be recognizable (regeneration 0-50% of the fin area) in the future: 1944 mark, dorsal and adipose fin clipped, 90.4%; 1945 mark, right pectoral fin clipped, 96.5%; 1946 mark, left pectoral fin clipped, 89.8%; 1947 mark, right pelvic fin clipped, 64.1%. Observations of fin regeneration suggested further that the calculated numbers of marked fish surviving in the mortality-growth experiments conducted at the same time should be adjusted upward, as it was demonstrated that from 0.2 to 20.8% of the survivors of the regeneration experiments had fully regenerated fins when examined at various times during the course of the experiments. The difference in mortality which occurred among marked and normal lake trout fingerlings in experiments performed under identical conditions and initiated with equal numbers of fish was concluded to be of insignificant proportions of the 1944, 1945 and 1947 markings. However, on the basis of chi-square tests for the departure of normal:marked fish from the originally established ratio, removal of the left pectoral fin appears to have resulted in a 16.1% increase in the instantaneous mortality among fish of the 1946 experimental group. Comparison of the growth of normal and marked lake trout fingerlings held in the same ponds indicates that removal of the dorsal and adipose fins (1944), right pectoral fin (1945), or right pelvic fin (1947) had no effect on the growth of the marked fish; the differences had no statistical significance. However, the left pectoral mark used in 1946 appears to have slowed growth of the marked fish by a small (8.6 mm), but statistically significant, amount.

SHETTER, D. S. 1952. The mortality and growth of marked and unmarked lake trout fingerlings in the presence of predators. Transactions of the American Fisheries Society 81 : 17-34.

Two experiments were conducted between October 4, 1948 and October 25, 1949 at the State Fish Hatchery at Marquette, Michigan, to determine the effect of predation on fin-clipped lake trout (*Cristivomer namaycush*) fingerlings. One experiment involved 4,000 unmarked fish and 4,000 clipped fish confined in the presence of adult brook trout, brown trout, rainbow trout and lake trout.

In a smaller experiment, another pond was divided by fish tight screen and bulkhead. In the lower half, weighted brush piles were added to provide cover. The upper half was left without cover. Into each half of this pond 500 marked fish and 500 unmarked fish were released along with various predator fish. The small experimental pond was covered with chicken wire screen to prevent bird predation.

Observation of deaths caused by factors other than predation, plus the counts of survivors at several examinations revealed the numbers of fish lost to the predator fish between various dates. Chi-square analysis of predation loss in the two experiments shows that the proportion of marked fish among the predator-caused mortalities was not significantly greater than for unmarked fish. Statistical analysis shows no significant difference in the growth of marked and unmarked fingerling lake trout in the presence of predatory fish.

Clear-cut results concerning the effect of cover on mortality of marked and normal fish in the presence of predators was not obtained. Unobserved deaths of predator fish in both parts of the split pond invalidated efforts to keep the amount of predation equal at all times in the two experimental enclosures.

SHUPP, B. D. 1973. Results of a four year study of the lake trout (*Salvelinus namaycush*) in Raquette Lake, Hamilton County, New York. New York State Department of Environmental Conservation. Warrenburg, New York. 45 p.

From 1933 to 1972 the New York State Department of Environmental Conservation removed 16.0 million lake trout eggs from 5,395 acre Raquette Lake. However, 15.6% of those eggs were replaced by the stocking of 2 5 million fingerlings and yearlings. Even with an average stocking rate of 64,100 fish per year

(12 fish per acre), the mature lake trout population continually declined over this forty year period. In 1968, a four year study was initiated to determine the status of the lake trout population and to compare it with populations of the past. The contribution of the stocking program was also evaluated by fin clipping a portion of the fish stocked during the study years. Jaw tags were placed in 1,065 mature fish during spawn taking operations. Over 90% of the mature females handled were over 20 inches in total length. The average 20 inch female is eight years old. Evaluation of 1969 recaptures of fish tagged in 1968 indicated a 35.7% annual mortality rate. A 21.6% angler exploitation rate was calculated from 1969 angler tag returns. The annual 1969 harvest was 494 lake trout. Of these, 53.6% were between 15" and 20" (immature). Crude population estimates place the 1930-1943 spawning population between 3,000-10,000 fish. The 1968-1971 adult population was reliably estimated at an average of 1,100 fish. Standardized gill netting in 1972 disclosed a dense population of 7" to 16" immature lake trout. Recoveries of fin clipped fish indicate that most of the juveniles result from stocking. Fish resulting from the 1969 fingerling stocking were recovered at a 7.5:1 ratio over those from the older, larger yearling plants. A study begun in 1966 to evaluate the effectiveness of injecting hormones to stimulate female lake trout to release eggs, was terminated in 1968 when it appeared that no efficiency could be gained by using this process at Raquette Lake. Angler tag returns from the fish used in the hormone experiment were only 48.8% of the returns from the routinely stripped fish. This implies that increased stress incurred during the hormone treatment may have induced additional mortality.

The study concludes that over-harvest of immature lake trout was the dominant reason for the population decline. Egg take may have also contributed after the population was reduced and the percentage of eggs removed became a significantly higher percentage of the total eggs available.

Recommendations for increasing the population are presented, including changing the size limit from 15" to 21" to protect the immature fish.

SIESENNOP, G. D. 1992. Survival, growth, sexual maturation and angler harvest of three lake trout strains in four northeastern Minnesota lakes. Fisheries Investigational Report 419. Minnesota Department of Natural Resources. St. Paul, Minnesota.

Performances of three strains of lake trout (*Salvelinus namaycush*) were evaluated in four lakes in northeastern Minnesota. Lake trout were stocked as spring yearlings and then monitored with trap nets, gill nets, and winter creel surveys for up to nine years. Trout of the native Gillis Lake strain survived better after stocking, and subsequently contributed more to the angler catch than the Isle Royale or the Marquette strains, when stocked with them. The differential survival by strain (and perhaps by year class) may be determined within the first few months after stocking, as the ratios in which the strains were captured by various nets or anglers remained nearly constant. Predation by older lake trout or condition at stocking may have influenced survival of newly stocked yearlings.

Growth and age at sexual maturity were similar among strains within lakes, but lake-to-lake differences in growth and sexual maturation were large and dependent on the kinds of forage fish available. Juvenile lake trout grew and matured most rapidly in Birch Lake, and progressively slower in Mayhew, West Bearskin, and Duncan lakes. Growth curves suggest the maximum size reached in the four lakes is negatively related to juvenile growth rates. Growth in West Bearskin Lake accelerated three to four years after stocking, presumably when lake trout were able to consume rainbow smelt (*Osmerus mordax*) a relatively large prey item which was absent or rare in the other lakes. These results show lake trout stocks used for rehabilitating stressed lake trout fisheries, and for re-establishing populations in lakes where they had been extirpated should be from the local geographic area. Non-native or hatchery stocks may be less able to cope with potential predators or competitors, and may exhibit lower survival. The Schnute general growth model is recommended for describing growth and for comparing growth of fish stocks.

SLY, P. G. and C. C. WIDMER. 1984. Lake trout (*Salvelinus namaycush*) spawning habitat in Seneca Lake, New York. Journal of Great Lakes Research 10(2) : 168-189.

Lake trout from Seneca Lake provide an important source of stock for Great Lakes rehabilitation but the lake trout in Seneca Lake have been hatchery supported, themselves, for many years. The earliest known stocking of lake trout took place in 1894. In more recent years eggs have been taken from wild fish, reared and released at both the fingerling and yearling stages. In most years between 1927 and 1972, large numbers of fingerlings were stocked, typically 150,000 to 250,000 per year, but none were stocked between 1972-1978. Yearling stockings remained low until the early 1940s, after which numbers were maintained between 20,000 and 30,000 per year until 1979. In that year the stocking of fingerlings was resumed and yearlings were increased to about 40,000. Stocking of fingerlings was resumed after it was found that their survival in Seneca Lake and other Finger lakes was significantly better than formerly believed.

Initially, lake trout stocking was undertaken to support a growing fishery but, with the loss of natural replacement, the remaining stock has become hatchery dependent. Further, as a result of reduced stocking, continued fishing pressure and increased lamprey predation, lake trout populations in Seneca Lake have been much reduced in recent years. Based on fish clip data, the proportion of hatchery-reared fish in the total population has risen from about 85% during the 1970s to about 95% at the present time. There is no indication of reduced egg survival in the hatchery which might be related to lake contamination effects. Our survey observation (1980-81) indicate that the lower parts of deep water cobble gravels have become much degraded by fine particulates making such sites unsuitable for spawning lake trout. Since no controlling relationship was found between long term decline of the lake trout population and climatic variation, it is believed that degradation of lake spawning sites has strongly influenced natural recruitment.

SMALLWOOD, W. M. 1918. An examination of the policy of restocking the inland waters with fish. The American Naturalist 52 : 322-352.

SNUCINS, E. 1983. Assessment of stocked lake trout reproduction in Fraleck Lake using small mesh gillnet, November 3-4, 1983. File Report. Ontario Ministry of Natural Resources. Sudbury, Ontario. 4 p.

Lake trout were not present in Fraleck Lake until 2,000 were planted in the spring of 1977. In order to determine if successful reproduction by the stocked fish had occurred, a netting survey was carried out in November 1983. No lake trout were caught. Lake trout recruitment was not confirmed by this survey.

SNUCINS, E. J. 1986. Tyson Lake – lake trout stocking assessment. File Report. Ontario Ministry of Natural Resources. Sudbury, Ontario. 11 p.

SNUCINS, E. J. 1992. Relative survival of hatchery-reared lake trout, brook trout, and F_1 splake stocked in low pH lakes. North American Journal of Fisheries Management 12(3) : 460-464.

A matched planting experiment was conducted to determine the most suitable salmonid genotype for stocking in former lake trout lakes that currently are too acidic to support lake trout reproduction. Hatchery- reared lake trout (*Salvelinus namaycush*), brook trout (*Salvelinus fontinalis*), and F_1 splake (*S. namaycush* x *S. fontinalis*) were planted in May 1989 at age 18-19 months in four lakes with pH values of 4.0-5.4. Relative survival of the three genotypes was assessed during a four day holding period immediately after stocking and by gillnetting during the summer of 1990. During the four day holding period, survival of lake trout (23%) was significantly lower than that of brook trout (98%), and splake (92%). Gillnetting recovery rates were 0-0.9% for lake trout, 0-1.8% for brook trout, and 1.1-15.0% for splake. The results of this study suggest that splake are the most suitable of these three salmonid taxa for stocking on a put-grow-take basis in lakes of pH 4.9-5.4.

SOLDWEDEL, R. H. 1978. See how they grow: A status report on Round Valley Reservoir's lake trout. New Jersey Outdoors 5(3) : 6-7.

In March, 1977 Round Valley Reservoir was stocked with 6,300 yearling lake trout that ranged from 4 to 7 inches in length. This was the initial introduction in our attempt to establish a fishery for lake trout in New Jersey. Lake trout eggs were provided from the state fish hatchery at Marquette, Michigan.

Gill netting was undertaken during the first week in November. One lake trout was taken in nets set between 10-20 feet in depth. Five lake trout were taken in nets set at 65 feet. The lake trout ranged from 8-10 inches in length. Stomach analysis indicated that the lakers were feeding entirely on *Gammarus*.

We will continue to stock fin clipped lake trout and monitor survival and the evidence of any natural reproduction.

SPETZ, C. E. 1969. Inventory and cataloging of the sport fish and fish waters in the interior of Alaska. p. 301-317. *In* Sport Fish Investigations of Alaska. Alaska Department of Fish and Game, Annual Report of Progress 1968-69, Volume 10.

Harding Lake was test netted for 290 hours to assess the lake trout (*Salvelinus namaycush*) population. Evidence of lake trout reproduction and survival of stocked fingerlings has not been found. Harding Lake was stocked with 252 adult lake trout in 1963 and again with 235 in 1965. Also in 1965, 88,000 eyed lake trout eggs were placed in the lake of which 75,000 were estimated to have successfully hatched. In 1967, 31,200 lake trout fingerlings were planted. Test netting revealed only three lake trout from the 1963 plant and one from the 1965 plant.

STANFIELD, L. W. 1982. Lake trout spawning shoal investigation of five lakes in the Temagami District. File Report. Ontario Ministry of Natural Resources. Temagami, Ontario.

Five lakes located within the Temagami District and known to contain lake trout (*Salvelinus namaycush*) were investigated to determine if trout were spawning, where, when and to what extent. All five lakes (Hearst, McNab, Rabbit, Rossevelt and Whitney) has been stocked in recent years with lake trout.

Rabbit Point remains the only documented spawning shoal in Rabbit Lake and spawning occurs in shallow waters susceptible to late winter drawdowns by Ontario Hydro making the shoals susceptible to freezing. Natural reproduction in the other four lakes does not appear to be sufficient to warrant discontinued stocking.

All future stockings of lake trout should be done using fin clipped fish if the objective is to eventually prove natural reproduction. Introductions with the intention of creating a reproducing population should be planned and studied to verify success or failure of the project.

STEWART, C. A. 1995. Percent stocked Lake Simcoe lake trout (*Salvelinus namaycush*) and lake whitefish (*Coregonus clupeaformis*) calculated from winter angler sampling programs. Lake Simcoe Fisheries Assessment Unit Report 1994-6. Ontario Ministry of Natural Resources. Sutton, Ontario.

With the exception of 1984 and 1985, winter creel information has been collected on Lake Simcoe every year from 1974-1994. The proportion of clipped (stocked) lake has ranged from 13.3% (N=60) in 1975 to 100.0% (N=157) in 1994. The proportion of hatchery-reared lake trout has consistently exceeded 90% since 1982.

STEWART, T. J. 1987. Lake trout stocking assessment on Dickey Lake, 1981-1985. Haliburton-Hastings Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Bancroft, Ontario. 20 p.

This study was undertaken to assess the lake trout stocking program on Dickey Lake and explore the applicability of assessment unit information to stocking assessment. The objective of the lake trout stocking program in Dickey Lake is to supplement the existing fishery by providing additional angling returns above those provided through natural reproduction. Planting rates on Dickey Lake have been relatively consistent since 1974 (3.74-7.71 fish/ha) with the exception of a high rate (14.15 fish/ha) in 1984. Size at planting varied between years with those of 1974 and 1975 being atypically small (11.4 gm) and that of 1982 being exceptionally large (21.4 gm). The fish stocked have primarily been of Lake Manitou origin having been raised in White Lake, Pembroke and Westport hatcheries. Prior to 1977 all planted fish were transported to Dickey Lake by aircraft. Beginning in 1977, fish were transported to the lake by hatchery truck.

From 1981 to 1985 planted lake trout have comprised from 13.5% to 67% of the seasonal lake trout harvest (average 28%). In general, percent occurrence of planted fish in the creel was highest in winter. The relative percent occurrence of individual year classes varied greatly. The 1973 and 1974 year classes (stocked in 1974 and 1975 respectively) contributed little to the fishery over the years 1981 to 1985. The 1980 year class of hatchery fish (planted in 1981) was age four in the winter of 1984 and comprised approximately 12% of the anglers catch. Planted lake trout are caught in very low numbers as young as age II during the first winter following planting. Growth of planted lake trout between the ages of IV and VI was 3-4 cm per year in fork length and approximately 100 grams per year in weight. Growth of planted lake trout of Lake Superior origin was slower despite larger size at planting.

The supplementation to the fishery provided by individual planted year classes is of short duration in Dickey Lake. Individual cohorts of planted lake trout supplemented the fishery for about three years. The recruitment of planted fish to the fishery provides catches of fish in addition to native fish. Higher return rates may have been associated with larger mean size of fish at time of planting.

STICKNEY, R. R. 1994. Use of hatchery fish in enhancement programs. Fisheries 19(5) : 6-13.

The practice of stocking hatchery fish is coming under increasing criticism. Views that genetic integrity may be altered by the intermingling of wild and hatchery fish originating from different stocks and that hatchery fish have been genetically altered as a result of generations of selection are widely held. Past breeding and hatchery management practices have produced instances wherein hatchery fish were poorly prepared to compete in the wild.

STOKELL, G. 1955. Mackinaw or great lake char. p. 138. *In* Fresh water fishes of New Zealand. Simpson and Williams Ltd. Christchurch, New Zealand. 145 p.

Fifty thousand eggs of Mackinaw/Great Lakes char (*Cristivomer namaycush*) were imported by the New Zealand Government in 1906 and were hatched by the North Canterbury Acclimatization Society in its hatchery in Christchurch. The Society's annual report for 1907 states that about 4,000 young fish were liberated in Lake Person in Canterbury and a similar quantity was forwarded to Westland for liberation by Government fishery officials. This account differs somewhat from that of the late T. E. Donne, Government Tourist Officer, at whose instigation the eggs were obtained and who states that the fry were liberated in lakes Pearson and Grasmere in Canterbury and Lake Ianthe in Westland. Still further lack of agreement is manifest in the account of the late G. M. Thomson who records the intended destination of the Westland lot as Lake Kanierir and states that the fry were never liberated there in consequence of their accidental loss through carelessness of the person who had them in charge. A few of the young fish were retained in Christchurch for exhibition in the aquarium which was a distinctive feature of the exhibition held in 1906-07 and were later pond-reared until they were mature when a second generation was bred from them, but what became of this lot is unknown.

STOKES, D. and S. CHALK. 1978. Lake trout netting program on McCann Lake, Proudfoot Township. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 12 p. + appendices.

A extensive stocking program, involving both brook trout and lake trout, was undertaken on McCann Lake between 1950 and 1976. During the period from 1960 through 1976, a total of 13,750 yearling lake trout were stocked.

From the survey on McCann Lake, it was obvious that many prime spawning areas exist in the lake. The existing lake trout fishery would not be inhibited at all due to the lack of spawning areas. Native trout should be produced at a fairly constant rate. This fact is reflected in the catch records since only 6% of the fish caught had identifying marks.

Limited stocking of lake trout should be continued to supplement the loss of lake trout by predation and harvesting by man of naturally produced lake trout. Monitoring of the winter and summer fishery should be continued in greater detail so that numbers of lake trout needed in stocking the lake can be determined to maintain the lake trout fishery in an optimal state.

SUNDE, L. A. 1968. Manistikwan trout transfer, September-October 1961. Fisheries Branch File Report. Manitoba Department of Mines and Natural Resources. Winnipeg, Manitoba. 6 p.

SUTHERLAND, C. and J. LAWRENCE. 1978. Summer creel census on Lake Simcoe 1978. File Report. Lake Simcoe Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Sutton, Ontario. 45 p. + appendices.

During eighty-six census days between May 1 and September 15, 1978, 1967 anglers were interviewed for creel census statistics on Lake Simcoe. Catches were dominated by yellow perch (75.4%) and smallmouth bass (13.7%). The non-specific catch-per-unit-effort (CUE) was 0.77 fish per angler hour. It was estimated that 158,987 angler hours were spent to catch 131,504 fish. Harvest and CUE data were calculated by creel census area and by species. Smallmouth bass, yellow perch, northern pike and lake trout were most actively sought by anglers.

Information on party size, number of lines, angler origin and fish caught per angler and party are discussed. Suggestions are made for improving creel census design, methodology and data analysis.

Lake trout caught by anglers had a mean age, weight and total length of 7.8 years, 3973 grams, and 68.0 cm, respectively. Sixty-nine percent of the lake trout caught by anglers were hatchery fish. Hatchery fish comprised 61% of the lake trout between three and seven years old, while older fish were more likely to be of natural origin.

SWAINSON, R. 1980. 1980 winter creel census on Aylen and Bark lakes. File Report. Algonquin Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Whitney, Ontario. 30 p.

During the period January 1 to March 31, 1980, 185 angling parties were interviewed on Bark Lake. These anglers exerted an estimated 11,000 rod hours of effort to harvest an estimated 520 lake trout and 174 lake whitefish. The estimated lake trout yield from the winter fishery was 0.25 kg ha^{-1}.

The lake trout fishery in Bark Lake is supported by several year classes of trout and a large proportion of these are hatchery stocked fish. Twenty-one percent of the lake trout had adipose fin clips (1973 stocking) and twenty-seven percent of the lake trout had left ventral fin clips (1974 stocking). Forty-three percent of the lake trout in the catch had no clips and may have been stocked in 1976. The remaining 9% of lake trout were comprised of various clips from other years.

Stomach contents revealed that the lake trout were feeding almost entirely on smelt.

SWAINSON, R. 1981. 1981 winter creel census on Aylen Lake and Bark Lake. File Report. Algonquin Fisheries Assessment Unit. Ontario Ministry of Natural Resources. Whitney, Ontario. 21 p.

Interviews were conducted with 1982 angling parties on Bark Lake during the 1981 winter creel census. An estimated 11,071 rod hours of effort were exerted by anglers in 1981. An estimated 368 lake trout were harvested from Bark Lake which represents a yield of 0.163 kg ha^{-1}. The catch-per-unit-of-effort (CUE) for lake trout was 0.03 fish per rod hour.

It was found that 29% of the lake trout catch was adipose fin clipped (1973 plant). Left ventral fin clipped fish (1974 plant) formed 23% of the creel. Forty percent of the lake trout caught had no clips and may have been stocked in 1976. The remaining 8% of lake trout were comprised of various clips from other years.

TAUB, S. H. 1963. Recovery of a marked lake trout after 21 years. Transactions of the American Fisheries Society 92(4) : 432.

On January 19, 1963, an ice fisherman caught a 32 inch, 9 pound marked (left pectoral fin clip) female lake trout (*Salvelinus namaycush*) in 550 acre East Twin Lake, Salisbury, Connecticut. Records of the Connecticut Board of Fisheries and Game reveal that 1,700 yearling lake trout were marked by a left pectoral fin clip and stocked there in November 1941. This was the last known stocking of lake trout in East Twin Lake. There is very little information in the literature on long term recovery of fin clipped lake trout. This recovery, after 21 years, may well be a record.

THOMAS, B. 1994. 1994 spring index netting on Sand Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 5 p.

Sand Lake, Proudfoot Township, is a large coldwater lake which provides a diverse fishery and is currently being stocked supplementally with 2,500 yearling lake trout on a two year rotation. Historically, the lake has been stocked with lake trout since 1949, brook trout from 1941-1958, rainbow trout from 1950-1989 and bass for a single year in 1914. A variety of sampling programs over the years suggest that these stocked fish comprise a large portion of the population. Contaminant monitoring in 1979 resulted in the capture of 21 lake trout of which 62% were fin clipped. In 1981, a lake trout assessment program had 43% clipped fish and in 1984 netting on the spawning beds resulted in the capture of ten fish of which none were clipped. The most recent sampling of fish occurred during the 1994 winter creel survey with all 32 fish being fin clipped. The estimates of the percentage of stocked fish are only minimums as a combined total of 38,000 lake trout were stocked in 1972 and 1974 with no identifying clips.

A spring index netting program, involving 60 30 minute net sets, was conducted over a seven day period from May 26 to June 3, 1994. A total of 11 lake trout were captured representing a catch rate of 0.183 fish/46 m net. All lake trout captured were clipped indicating they were of hatchery origin.

It appears that lake trout abundance in Sand Lake is relatively low considering the two year stocking cycle, large volume of suitable habitat and limited angler harvest. A decline in native stocks over the years suggests a problem with natural recruitment. This may be partially due to predation and competition with smelt in the lake.

THOMAS, B. 1998$_a$. 1998 spring littoral index netting on Bigwind Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 2 p.

Bigwind Lake is currently managed , through supplemental stocking, as a lake trout fishery. Historically the lake has been stocked with both brook trout and lake trout. A spring littoral index netting (SLIN) was conducted in the spring of 1998 to determine the status of the lake trout population and the relative abundance of other species to support future management decisions.

A total of eighteen 90 minutes nets sets were completed over a period from April 19-24, 1998. Twenty lake trout, representing a catch rate of 1.111 fish/91 m of net, were captured. Clipped fish accounted for 100% of the lake trout catch. It appears that the lake trout population of Bigwind Lake owes it existence to the local stocking program.

THOMAS, B. 1998$_b$. 1998 spring littoral index netting on Loxton Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 3 p. + appendices.

Loxton Lake is a small (101 ha) coldwater lake in Ballantyne Township. Historically, the lake has been stocked with lake trout, brook trout and rainbow trout. Brook trout stocking was discontinued due to the presence of an established population of yellow perch while lake trout and rainbow trout stocking was discontinued as a result of poor returns from past netting activities. A spring littoral index netting (SLIN) program was conducted in the spring of 1998 to determine the status of the lake trout population and the relative abundance of other species to support future management decisions.

A total of forty 90 minute sets were completed between April 21-May 13, 1998. A total of six lake trout, representing a catch rate of 0.150 fish/91 m of net, were captured. Clipped (RV) fish accounted for five of the six trout (83%) captured. Weights of lake trout captured ranged from 4,500-5,900 grams with a mean of 4,547 grams. It appears that the lake trout abundance in Loxton Lake is low but the sample of such large fish confirms that suitable habitat exists in the lake.

THOMAS, B. 1998$_c$. 1998 spring littoral index netting on Long (Cardwell) Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 3 p. + appendices.

Long (Cardwell) Lake is currently managed, through supplemental stocking, as a lake trout/lake whitefish fishery. A total of forty 90 minute gill net sets were conducted between April 22-May 12, 1998. A total of 6 trout (0.150 fish/91 m net) were captured. Five of the six fish captured (83%) were fin clipped.

It appears that the lake trout population in Long (Cardwell) Lake is largely the result of the district stocking program. The one large, unclipped fish may possibly be of hatchery origin with a missed clip or a regenerated fin.

THOMAS, B. 1998$_d$. 1998 spring littoral index netting on Peninsula Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 2 p.

Peninsula Lake (865 ha) is currently being managed as a put-grow-take lake trout fishery. A spring littoral index netting program was conducted between April 20-May 1, 1998 to determine the status of the lake trout population. Twenty-three 90 minute gill net sets produced a catch of 20 lake trout (0.870 fish/91 m net). Weights of trout ranged from 280-3,600 (mean of 1,024 gm) grams. Clipped fish represented 100% of the catch. It appears that lake trout abundance is relatively high in Peninsula Lake given the large population of northern pike. The percentage of clipped fish suggests that this fishery is very dependent on the district stocking program.

THOMAS, B. 1999. 1999 spring littoral index netting on Emsdale Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 2 p.

Lake trout were introduced to Emsdale Lake in 1976 and stocking has continued to the present. A stock assessment program in 1986 revealed that the stocked lake trout had become self-sustaining with 67% of the fish sampled being the result of natural reproduction.

A spring littoral index netting program was carried out from April 26-May 9, 1999 to determine the status of the lake trout population. A total of thirty 90 gill net sets produced a catch of nine lake trout (0.300 fish/91 m net). Three additional overnight gill net sets produced a catch of 12 lake trout. In total, 21 lake trout were captured. Unclipped trout represented approximately half of the sample (10 of 21 fish).

THOMAS, E. R. 1979. Status of the Mijin Lake fishery and management recommendations. File Report. Ontario Ministry of Natural Resources. Wawa, Ontario. 24 p.

Mijinemungshing (Mijin) Lake is a 605.8 ha lake situated in Lake Superior Provincial Park. The lake was managed as a brook trout fishery from 1958 until 1966 when a single introductory planting of 8,000 yearling lake trout (LP,RV fin clips) was carried out. No efforts were made to protect these fish from exploitation through the imposition of fish sanctuary status.

In October of 1969 a total of 53 lake trout were netted. All fish, now at 4+ years of age, were fin clipped. In November 1970, a total of 31 lake trout were netted. All fish (age 5+) were fish clipped. Twelve of the nineteen males (63.2%) were mature while only one of twelve female trout (8.3%) were mature. This report summarizes results derived from a summer creel census program which was conducted between June 5 and September 5, 1977.

Of the 316 lake trout scales which were successfully aged, the majority (54.4%) were found to be from age 5+ fish. Although four scales were aged as 7+ and two as 8+, it is felt that these were improperly aged due to their suspected early hatchery background. In fact, these fish were quite probably age 12+ and representatives of the original plant. If age 7+ and 8+ trout were, in fact, present in Mijin Lake, it would have been necessary for the originally planted fish to have spawned at ages 3+ and 4+. As further confirmation, all but one of these fish possessed a fin clip, indicative of the 1966 plant. Little difficulty was encountered with the age 5+ scales due to the native origin of the trout involved.

It is suggested that the Mijin Lake lake trout fishery may be overharvested. Angling pressure and harvest are felt to have been significant factors affecting the 1966 planted fish as well as their offspring. The age 5+ year class is expected to be the strongest represented in the angling harvest for two reasons. First, it was derived from the original plant when the largest number of fish first spawned, in 1972, at age 6+. Additionally, this is the year class (age 5+) in which the majority of individuals first enter the angling fishery. It is expected that the number of fish remaining from the 1966 plant may have become limiting to year class strength by 1974 or 1975.

Stocking of yearling lake trout might produce some positive benefits if carried out in 1983, 1984 and 1985. These plantings would serve to bolster the age 1+ progeny year classes of the suspected weak 1975, 1976 and 1977 year classes as they pass respectively through their first major year of spawning at age 6+. In particular, when ages 6+, 7+ and 8+ are occupied by these weak year classes, poor recruitment to the 1984 year class might be expected. Stocking of yearling trout in 1985 would therefore appear to offer the greatest potential for benefiting the population.

THURSTON, L. 1976. Assessment of lake trout plantings. File Report. Ontario Ministry of Natural Resources. Parry Sound, Ontario. 4 p.

During the spring and summer of 1976, fourteen lakes were netted with standard lake survey gill nets to assess the success of past plantings. Another five lakes were assessed from past creel census data and information supplied by ardent anglers. The assessment revealed the obvious lack of success in Mill and Horseshoe lakes. The success in another four lakes (Otter, Sollman, Crane, and Trout Lake) was less than satisfactory and will require additional evaluation. The remainder of the stocked lakes showed a good response to stocking. These included Whitefish, Star, Darlington, Fairholme, Blackstone, Silver, Portage, Three-Legged, and Lorimer lakes. The summer assessment also revealed that four lakes (Caribou, Clear, Spider and Wahwashkesh) supported populations of naturally recruited trout, however naturally recruited trout caught per gill net lift suggested all four lakes support only a fair to poor lake trout fishery. It is felt that these self-supporting lakes require more protection to establish whether such lakes can continue to support viable sport fisheries for lake trout.

THURSTON, L. 1977. Summary of two years (1976-77) of lake trout assessment work in the Parry Sound District. File Report. Ontario Ministry of Natural Resources. Parry Sound, Ontario.

Based on the results of two years of assessment work on lake trout lakes within the Parry Sound District, trout lakes were classified in three categories. The placement of a lake was based on the success of gill net catches and/or creel census work. Lakes in the first category are those having an ample population of lake trout and will continue to be managed for lake trout. Lakes in the second category are those showing questionable results and will be managed over the next few years for lake trout but may be dropped as lake trout candidates pending assessment results in three to five years. Lakes in the third category are those which produced poor results and will not be managed for lake trout in the future.

TOMPKINS, B. 1956. Fishing in the drink...at Quabbin Reservoir. Massachusetts Wildlife 1956 (January-February) : 2-5.

Ten thousand lake trout fingerlings, secured from Vermont, were introduced into the Quabbin in the fall of 1952 followed by 7,500 in 1953. By that time our trout hatcheries at Montague and Sunderland had turned some of their production into lakers and from 1953 to the fall of 1955 they stocked over 125,000 fingerlings and 7,500 yearlings and two year olds of this species.

During 1955, lake trout were taken in experimental netting gear. It is believed that the species will become self-perpetuating when once established.

TREPANIER, D. B. and D. MAW. 1978. 1978 lake trout netting program on Solitaire Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 13 p. + appendices.

The stocking program on Solitaire Lake began in 1939 and has continued until 1976. A total of 17,600 lake trout and 33,600 brook trout have been stocked over that period of time. Based on netting conducted in 1979 the lake trout netting index was 7.49 100' hours/trout. A total of 27% of all lake trout captured exhibited a right pectoral fin clip with the exception of one which had an adipose clip. The remaining fish had no fin clips present. These findings conflict with stocking records with state that lake trout planted in 1976 were clipped on the right ventral fin. The lack of clips on 73% of the fish appears to indicate that natural reproduction is occurring at a fairly substantial rate. It is recommended that the stocking program be continued.

TREPANIER, D. B. and D. PRIOR. 1979$_a$. 1979 lake trout assessment on Oxtongue Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 20 p. + appendices.

Fish stocking in Oxtongue Lake (246 ha) began in 1931 and continued until 1977. A total of 76,300 lake trout, 51,100 brook trout and 37,950 rainbow trout have been introduced over this period of time. Based on catches from gill netting, the native stock appears to be doing quite well as 82.2% of the catch was comprised of unclipped fish. All of the stocked fish were small and it appears that stocked fish are not surviving long enough to reach a suitable harvest size. It certainly appears that the returns to the anglers are minimal with respect to stocked fish.

TREPANIER, D. B. and D. PRIOR. 1979$_b$. 1979 lake trout netting program on Red Chalk Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 17 p. + appendices.

Fish stocking in Red Chalk Lake, Ridout Township, began in 1936 and has continued until 1978. A total of 26,000 lake trout, 34,450 brook trout and 19,950 rainbow trout have been planted over this period. During a netting program, 23.8% of the lake trout captured exhibited a fin clip while the remainder (76.2%) had no markings of any kind. The stocked fish ranged in size from 110 grams to 4,550 grams while native trout varied from 600-1,700 grams. It appears that there is a deficiency in the number of fish represented in the smaller size classes, particularly small native fish. This might indicate a depressed level of natural reproduction.

Introduced lake trout in this lake are having good success and are surviving in many cases long enough to provide good returns to the angler. This lake should continue to be managed as a lake trout fishery. The winter fishing pressure placed on it makes it imperative that the stocking program be continued on a regular basis.

TREPANIER, D. B. and D. PRIOR. 1979$_c$. 1979 lake trout netting program on Blue Chalk Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 17 p. + appendices.

Fish stocking in Blue Chalk Lake (50 ha) began in 1936 and has continued until 1978. A total of 26,000 lake trout, 34,450 speckled trout and 19,950 rainbow trout have been planted over this period of time.

Netting efforts in 1979 produced a wide range of lake trout sizes with representation in five size classes. The percentage of stocked fish (31.4%) which were represented in three size classes is good evidence that the stocking program is succeeding in this lake and is definitely serving to supplement the native population of trout. The high percentage of unclipped fish certainly is proof that natural reproduction is occurring at a fairly substantial rate. It also suggests that this lake could sustain a self-perpetuating, healthy population if the fishing pressure was not so intense.

This lake should continue to be managed as a lake trout fishery. The winter pressure placed on it makes it imperative that the stocking program be continued.

TREPANIER, D. B. and D. PRIOR. 1979$_d$. 1979 lake trout netting program on Harp Lake, Chaffey Township. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario.

Harp Lake is relatively small lake with a surface area of only 68.8 ha. Potential spawning facilities are evident but are not ideal. Successful spawning is not occurring at a suitable rate as evidenced by our netting results. The high percentage (78%, N=18) of stocked fish captured during netting is excellent evidence that the stocking program is supplementing the small native population. These results indicate that this fishery could not hope to survive without the constant aid of introduced fish, thus an intensive stocking program.

TREPANIER, D. B. and D. PRIOR. 1979$_e$. 1979 lake trout netting program on Lower Fletcher Lake. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 18 p. + appendices.

Lower Fletcher Lake is a relatively small lake with apparently a small population of lake trout. Fish stocking in Lower Fletcher Lake began in 1942 and continued until 1977. A total of 23,600 lake trout and 13,354 speckled trout have been stocked during this period. The native stock of trout appears to be all but absent based on netting results and discussion with cottagers. The netting effort produced an index of 41.9 100' hours per trout which is moderately high. Over eighty percent (83.3%) of the trout caught were all very small, immature introduced fish. The absence of any fish for age classes 30-50 cm indicates that very few, if any, stocked fish are surviving for any appreciable time following their introduction. A self-perpetuating fishery is definitely not possible and it appears as though the stocking program is having little success in maintaining a fishery in this lake. The lake should be placed at the lowest stocking priority level.

TURNER, S. E. 1972. Fisheries management planning and research: Survival and growth of various sizes of trout stocked in Lake Taneycomo. Montana Department of Conservation. Helena, Montana. 33 p.

VAN WYCK, H. 1957. Lake trout experiment - Lake Simcoe. Department of Lands and Forests, Southwestern Region, Conservation Officers' Projects 1957-1958.

During the lake trout planting in Lake Simcoe in May and June of 1957, the following experiment was carried out to ascertain if these small fry would live in greater depths and pressures of water. A trap was made up 18" long and 10" diameter of fine wire screening and a buoy was established in 72 feet of water, north of Snake Island. At this buoy, on May 29th, two dozen fry were placed in this wire trap and immediately lowered to the bottom of the lake. One week later, on June 5th, this trap was brought to the surface, the fish were still living and seemed very healthy. It was released again and sent to the bottom. One week later, on June 12th, the cage was lifted and the fish released. These trout were in very good shape and their growth, while in the trap, was quite noticeable.

Since I have been with the Department I have been told, by different hatchery managers, that when planting fish in a lake, they should be released on shoals or in shallow water because these small fish raised in shallow water would not be able to stand great depths of water. And this has been the practice carried out in Lake Simcoe up to the present time.

The reason I tried this experiment was that when planting fish on these shoals, predator fish, mostly perch, were quite numerous and this no doubt would give a high mortality rate with these small fish. Perch do not frequent the deep water of Lake Simcoe.

VEALE, P. 1892. Ottawa hatchery. p. 53-54. *In* Supplement No. 1 to the Annual Report of the Department of Fisheries: Fisheries Statements and Inspectors' Reports for the Year 1891. Ottawa, Ontario.

VON GELDERN, C. E., Jr. and C. S. KABEL. 1960. Trout management study: Convict Lake creel census, 1958. California Department of Fish and Game. Sacramento, California. 31 p.

WALKER, V. 1979$_a$. Lake Manitou lake trout spawntaking operation 1958-1978. File Report. Ontario Ministry of Natural Resources. Espanola, Ontario. 54 p.

Annual lake trout spawntaking reports have been summarized and analyzed into one report describing the Lake Manitou spawning populations from 1958 to 1978.

Planted and native adult trout follow basically the same trend over time suggesting that environmental factors primarily are directing the variations in lake trout returns.

It was determined that multiple recoveries are constant over time and represent approximately 40% of the total catch. Of the adult trout collected, 26 to 79% were males. No evidence of a homing tendency has been discovered in tagged lake trout. Native trout appear to be generally more viable than planted fish in that a larger percentage of ripe females are produced on a percentage basis.

Results of the 1958 tagging study indicate an estimated survival rate of 54.32%. A 59.60% survival was determined for spawn taking females age VI and older whereas an average of 51.92% existed for nine year classes.

There is no definite relationship between the size of fish at stocking and lake trout returns. The date of stocking as well as the number of fish stocked appear to be directly related to trout returns. A model has been formulated to serve as a guideline with respect to the date at which stocking should be initiated in Lake Manitou. An optimal time period has been identified for which stocking is most productive.

The extent of the Indian fishery prior to 1976 cannot be evaluated.

WALKER, V. 1979$_b$. Lake Manitou winter creel census: 1975-1978. Ontario Ministry of Natural Resources. Espanola, Ontario. 26 p. + appendices.

The results of four years of creel census data from Lake Manitou are presented and compared. Fishing effort was highest in February. The month of March has the highest average success rate, January has the poorest. Native fish constitute less than 20% of the total harvest. In 1976 and 1978 approximately 90% of the catch was of hatchery origin. Seventy-seven percent of the winter lake trout fishery is drawn from fish of ages III, IV and V. Growth in length and weight is almost linear in the younger age classes and tapers considerably with the onset of sexual maturity at age VI. The survival rate for fish of age IV and older was determined to be 51.74%. A secondary analysis using the catch per units of effort resulted in an estimated 56.43% survival.

WALTER, C. J., L. D. JACOBSON and G. R. SPANGLER. 1986. The lake trout rehabilitation model: Program documentation. Great Lakes Fishery Commission Special Publication No. 86-1. Ann Arbor, Michigan. 33 p.

The objective of the Lake Trout Rehabilitation Model is to simulate changes in lake trout abundance using an age structured population model that realistically accounts for:

- Known time lags (between birth, stocking, maturity and recruitment to the fishery)
- Stocking policy
- Differences in the reproductive capability of wild and stocked fish
- Natural limits to recruitment (the stock-recruitment relationship and juvenile habitat capacity)
- Mortality due to natural factors, lamprey predation and fishing

Not included in the model are a number of more controversial relationships such as changes in the forage base, changes in the abundance of alternate hosts for sea lamprey and changes in lake trout habitat due to pollution. The "slow dynamic" of spawning habitat recolonization and adaption of local stocks is not considered; instead, it is assumed that all major spawning shoals are simultaneously recolonized as abundance of lake trout increases. The model starts from an initial condition of no fish. Abundance of lake trout increases as fish are stocked and as stocked fish begin to reproduce naturally. Thirty years of lake trout rehabilitation are simulated.

WARD, N. 2000. A review of fish stocking assessment in Kenora District. File Report. Ontario Ministry of Natural Resources. Kenora, Ontario. 7 p.

The Kenora District has a long history of stocking fish. A hatchery was built at Kenora in 1914 and was fully operative by 1917. This hatchery, built on the shores of Lake of the Woods, reared walleye eggs and fry, whitefish eyed eggs, lake trout fry and fingerlings, smallmouth bass fry and brook trout fingerlings. Records since 1946 indicate at least 117 waterbodies have been stocked in Kenora District with either brook trout, lake trout (also known as salmon trout), rainbow trout, walleye, smallmouth bass, muskellunge, whitefish, black crappie, rock bass and splake.

In 1985 and 1989, splake and lake trout were introduced, respectively, into Dogtooth Lake in an attempt to provide a fishery that would substitute for Dogtooth's extinct lake trout populations. In the late 1990s, the Kenora District attempted to obtain lake trout eggs from an upstream source (Kilvert Lake) to reduce the risk of introduced lake trout (from a Lake Superior strain) genetically contaminating lake trout populations downstream from Lake of the Woods. Only one female trout was obtained (and about 30 male fish) during the 1997 and 1998 netting program in Kilvert Lake thus splake stocking will be re-established in 2000.

WARFEL, H. E. and G. W. MORRILL, Jr. 1939. Stocking policy for streams and lakes of the Connecticut watershed. p. 9-81. *In* Biological Survey of the Connecticut Watershed. New Hampshire Fish and Game Department Survey Report No. 4. Concord, New Hampshire.

WARING, P. 1985. Lake trout management in Lake Simcoe. *In* 1985 Lake Trout Seminar: North Central Region, February 13-14, 1985, Thunder Bay, Ontario.

The Lake Simcoe lake trout fishery was discussed in relation to temperature and oxygen profiles. Historical introductions, commercial and sport harvests, and management alternatives were presented.

- Currently the population of trout is comprised of 4 different stocks originating from plantings of different parental origin.
- Males and females mature at age 5 and 6, respectively. Stock origin does not seem to influence this characteristic.
- Survival rate has been difficult to evaluate because of the uncertainty of aging using fin clips (growth overlap during clipping cycle). Survival has been estimated to be approximately 50% for ages 4-7.
- Recent data suggests that survival to recruitment is quite variable. The reason however is not known. It may be related to several factors: location and condition of the plant, the success of preceding introductions.
- The attainment of adequate levels of dissolved oxygen would appear to be prerequisite to the rehabilitation of lake trout.
- Fish culture will continue to play a significant role in maintaining the trout fishery.

WEBSTER, D. A. 1950. Fishery research program at Cornell University. Progressive Fish Culturist 12(2) : 77-80.

The principal fishery projects at Cornell University are long term investigations (5-10 years or more) set up to evaluate plantings of hatchery-reared fish, to obtain various population statistics which are valuable to fisheries management and to contribute to the general fund of knowledge regarding fisheries biology. Cayuga Lake, the principal site of our activities, is one of the Finger Lakes of central New York.

The lake trout in Cayuga Lake are of particular interest because the fishery has increased tremendously in the past few years. The size of the catch has increased from hundreds to thousands of trout per year since 1946. During the past four years, 135,500 lake trout have been fin clipped and planted. The State stocking policy has been to plant from 60,000 to 100,000 fingerling trout (20-50% of which have been marked) late in the summer. In addition to the fingerlings, 5-10,000 fin clipped yearling trout are planted early in the spring.

Gill netting to recover these marked trout was carried on intensively in 1949. Through the sample of juvenile trout taken was not large, it was sufficient to indicate a considerable proportion of marked hatchery fish in the population of small trout.

WEBSTER, D. A. 1955. Cayuga – A lake trout laboratory. New York Conservation 9 : 29-31.

Cayuga Lake has historically not supported an appreciable stock of lake trout for many years. The first substantial stocking of yearling lake trout (6,000 fish) was made in 1939 and annual plantings of that order were subsequently made. From 1946 through 1954, a total of 64,600 yearlings and 730,000 fingerlings were planted; since 1950 the annual stocking programs has stabilized at 8,000 yearlings and 80,000 fingerlings (half of which were marked).

An assessment program, comprised of gill netting, was initiated to evaluate the stocking program. It was found that the main food of stocked lake trout was alewife. It was also found that the catch of lake trout dropped off at depths of over 150 feet. The results of the sampling through 1954 have shown some consistent and clear-cut results bearing on the subject of fingerling versus yearling survival. In the seven year classes sampled , yearlings outnumbered fingerlings by an average of about 4 to 1.

We believe it is reasonable to conclude that the initiation of yearling plantings of lake trout in the 1930s was responsible for a marked increase in the lake trout population noted in the mid-late 1940s. We also conclude that some condition or conditions adversely affect natural production of lake trout in Cayuga Lake prior to the fingerling stage.

WEBSTER, D. A. 1958. Cayuga lake trout part 3: Their food, growth, survival and management. New York State Conservationist 12 : 11-14.

The Cayuga Lake studies, extending over a 12-year period (1946-1957) have involved observing the results of planting more than a million hatchery-reared lake trout. The results can be summarized as follows:

- The hatchery fish now planted by the Conservation Department at the rate of 80,000 fingerlings and 8,000 yearlings per year show satisfactory survival and produce angling of high quality. Yearling trout (about 5 inches long) planted in April show four times the survival of fingerlings ($3^1/2$ inches) planted in September. However, this superiority is not enough to offset the numerical advantage of fingerlings (about four times as many fingerlings can be reared for the same food costs and space requirements) and the related problems of carrying the fish in the hatchery for an additional six months.
- Natural reproduction of trout in Cayuga Lake is insignificant and presumably due to the poor quality of spawning areas. Taughannock Point, for example, has a heavy silt mantle on the bottom in the area selected by trout for spawning. All available evidence indicates inadequate spawning has been the rule for at least 75 years, perhaps much longer.
- Growth is rapid up to age six and a size of about 25 inches; thereafter it diminishes rapidly due to the onset of maturity. Alewives are the important food of all but the smallest trout.
- Owing to the growth rate and the high quality of fishing, Cayuga Lake anglers do not usually keep trout until they have reached a length of about 20 inches. The minimum legal length of 15 inches is thus non-restrictive in regulating the catch. At times of peak activity, many anglers take the 3-fish daily limit, hence this regulation does function to limit the total catch.
- Under present conditions many more trout in the Cayuga Lake population appear to die of natural causes than are caught by angling.

WEBSTER, D. A. 1959$_a$. Interpretation of catch curves derived from a hatchery maintained stock of lake trout in Cayuga Lake, New York. Transactions of 10th Annual Meeting of the Northeast Wildlife Conference, Montréal, Québec, January 4-7, 1958.

The population of lake trout in Cayuga Lake can be shown to be maintained by plantings of hatchery fish. Determination of reasonable levels of exploitation require statistics on natural mortality rates. These may be derived in the conventional fashion using catch curves based on age from distributions of lake trout taken in strict quantitative annual samples from 1950-56. Because a large proportion of the hatchery fish are marked, the effect of uneven recruitment on fluctuations in the age frequency is effectively controlled. Correct interpretation of the catch curve requires further adjustments: (1) There is a marked tendency to underestimate the ages of lake trout after age VI. (Data suitable for use in the catch curve must therefore be restricted to marked fish of known age.) (2) The age of groups of trout show a non-random distribution in the lake. Since this was taken into consideration in the sampling design an appropriate weighting of the age frequencies is possible. The net result of these adjustments is an essentially linear descending leg, from which the annual survival rate is estimated at 46%. (The gross unadjusted descending leg shows a sinuous concave-convex relation.) This estimated survival rate is verified by tag recapture data. The voluntary return of tags suggests a minimum "rate of exploitation" of about 5% a year. Even assuming fishing mortality is grossly underestimated, it appears the annual natural mortality rate is of the order of 40 to 50%. The information available suggests that Cayuga Lake could provide more fishing for lake trout. The most expedient means of doing this seems to be by increasing the length of the open season.

WEBSTER, D. A. 1959$_b$. Biology and dynamics of a hatchery-maintained stock of lake trout in Cayuga Lake, New York. p. 16 *In* Proceedings of the 12th Annual Meeting of Canadian Committee on Freshwater Fisheries Research, January 9, 1959, Ottawa, Ontario. (Abstract only)

The Finger Lakes of New York produce good lake trout fishing. However, there was no sustained yield of lake trout from Cayuga Lake until recently. Planting of marked fingerling and yearling hatchery-reared trout show the entire stock in Cayuga Lake is from hatchery fish. The poor spawning success in the lake is apparently due to siltation from adjacent tributaries.

The growth rate shows an inflection at sexual maturity, and considerably slower growth is observed after six years. Survival rate estimated from catch curves and tag returns after six years is about 46% per year. A higher mortality between ages III and IV could be due to lampreys, but lamprey predation is not sufficient to control lake trout abundance. Of the 54% average total mortality it is estimated that exploitation amounts to between 10% and 20% and natural mortality (including lampreys) from 30% to 40%.

The Seneca strain of lake trout tend to be deep spawning (from 100 ft to 200 ft) while lake trout from the Adirondacks tend to spawn in shallow water (up to 10 ft). Checks on survival in several New York lakes indicate low survival of Finger Lakes stock when planted in the Adirondack area. Most of the recoveries of marked fish planted in Lake Ontario are from the Seneca strain. The observations suggest that genetic background of the cultured stock is important and should be considered in the fish culture aspect of management.

Lake trout stocking is a potent management tool under favorable environmental conditions, but as with other types of stocking, judgement is required in application.

WEBSTER, D. A., W. G. BENTLEY and J. P. GALLIGAN. 1959. Management of the lake trout fishery of Cayuga Lake, New York, with special reference to the role of hatchery fish. Cornell University Agricultural Experimental Station 357 : 1-83.

Cayuga Lake has traditionally offered poor lake trout fishing as compared with the other Finger Lakes of New York. A study was initiated in 1946 to (1) evaluate fingerlings vs. yearling plantings of hatchery-reared lake trout, (2) evaluate contributions of hatchery plantings to the total population, and (3) obtain data pertinent to the general management program for lake trout in Cayuga Lake.

In the period 1946-1954, 310,000 marked fingerlings and 73,000 marked yearling lake trout were stocked; an additional 420,000 unmarked fingerlings were also planted. A sampling program began in 1950. This consisted of fishing 500-foot gill net gangs made up of a graded series of mesh sizes. A total of 25,000 feet of netting was fished each year in a predetermined fashion in 5 sample areas of the lake. In the period 1950-1955, the mean annual sample was 236 lake trout.

Yearling showed a fourfold higher representation in the 7 year classes adequately sampled. This superiority is not enough to offset the numerical advantages of fingerling plantings (about four times as many fingerlings can be reared for the same food cost and space requirements) and the additional problem of holding the fish in the hatchery for 6 months longer.

No advantage could be demonstrated for scatter-planting over spot-planting of fingerlings.

After pro-rating the unmarked fish in the sample on the basis of marked to unmarked fingerlings planted, it was clear that virtually all trout in Cayuga Lake were of hatchery origin. Presumably, natural spawning areas have not been adequate to maintain a successful fishery for at least the past half century.

Judging from the annual catch in standard gangs and from angler diaries, the lake trout population is comparatively stable under current stocking. Growth rate is rapid up to age VI and a total length of about 24 inches; thereafter it diminishes rapidly, probably because of the onset of sexual maturity. A dwarf population of alewives forms the nearly exclusive food of all but the smallest trout.

Statistics derived from the catch curve based on fin clipped fish, and corroborated by records of tagged fish, indicate a total annual survival rate after age V of 46%. The voluntary return of tagged fish suggests a minimum "rate of exploitation" of about 5% per year. Even assuming that fishing mortality is grossly underestimated, it appears that the annual natural mortality rate is of the order of 40 to 50%.

This information suggests that Cayuga Lake could provide more fishing for lake trout. The most expedient means of doing this seems to be by increasing the length of the open season – a possibility that needs to be evaluated for the Finger Lakes as a group.

WEIR, J. C. 1951. Notes: Game fish management: Sanctuaries and restocking. File Report. Ontario Ministry of Natural Resources. Maple, Ontario. 5 p.

Some years ago fish were stocked indiscriminately on the basis of public demand and request. The immediate need in the propagation phase of fisheries management is not expansion but a more selective stocking program to avoid indiscriminate and unwise stocking practices. Some general recommendations on stocking hatchery-reared lake trout include:

- Avoid planting trout in unknown lakes until a survey is made.
- Practice wide distribution when releasing fish.
- In general, the younger the fish, the closer they should be released to the natural spawning ground.
- Plant fish off gravel (rock-rubble) shores and shoals in deepening water depending on the size of fingerlings. The trout will go down immediately. Avoid planting windward shores.
- Avoid sudden changes in temperature from holding to site waters. Bring the water temperature in cans halfway up to the surface water temperature of the lake.
- Avoid areas dominated by predators.

WELCOMME, R. L. 1988. International introductions of inland aquatic species. Fisheries Technical Paper 294. Food and Agriculture Organization of the United Nations. Rome, Italy.

The lake trout has a wide natural distribution in the colder waters of North America penetrating up to the Arctic. Several attempts have been made to utilize the cold resistance of this species by introducing it to high latitude or high altitude sites in Europe, New Zealand and latin America. These attempts have met with little success and have resulted in a few isolated populations being established in large deep lakes in the Alps, Scandinavia, New Zealand and Argentina.

WHITE, R. J., J. R. KARR and W. NEHLSEN. 1995. Better roles for fish stocking in aquatic resource management. p. 527-547 *In* H. L. Schramm Jr. and R. C. Piper [eds.]. Uses and Effects of Cultured Fishes in Aquatic Ecosystems. American Fisheries Society Symposium No. 15. Bethesda, Maryland.

Artificial propagation and stocking have been a central feature of North American fishery management since its inception well over a century ago. Despite questions that have long been voiced about the effectiveness of fish stocking, citizens, fisheries agencies and legislators often pin hopes for the future of fisheries on stocking programs. Evidence that post-stocking performance (survival and reproduction) of hatchery-produced fish is inferior to that of wild conspecifics is abundant as is evidence that stocked fish harm wild fish. Post-stocking behavioral problems of hatchery fish appear at least as numerous and damaging as physiological and anatomical problems but receive less attention in culture programs; they may also be less solvable. Severity of culture-induced problems increases with the length of the period under artificial propagation; raising larger fish and more generations of captive-bred fish increase the likelihood of problems. The problems with stocking are worse in streams because streams tend to present harsher environments than do standing waters. Stocking is least successful where a reproducing population of the same species already exists so stocking programs should be separated from healthy and potentially healthy wild stocks. Supplementation, stocking of progeny of wild broodstock into the parent population, is especially likely to be counterproductive. Better evaluation of post-stocking performance and of effects on wild populations may improve programs is agencies act on the results. Evaluation of stocking programs should go beyond accounting for operations costs and monetary value of harvested fish; it should recognize full costs and benefits in economic, ecological and social contexts. Analysis of the environmental impacts of stocking should be done for each species and waterbody. State, provincial, tribal and federal programs should use fish stocking only within ecologically sound policies. The top priority of fishery programs should be protection of wild, native fish stocks and the environments upon which they depend.

WILMOT, S. 1888. Report of fish culture activities for 1887. Supplement to the Annual Report of the Department of Fisheries, Dominion of Canada. Ottawa, Ontario.

In 1887, a total of 2,090,000 salmon (lake) trout fry were reared at the Newcastle fish hatchery. These fish were stocked in the Great Lakes as well as inland waters of southern Ontario. Inland waters stocked with lake trout fry in 1887 included Kushog, Crooked, Drag and Redstone lakes in the Haliburton area, Eagle Lake, L'Amable, Humphrey's Lake and Bartlett's Lake in north Hastings, Lake Simcoe and Lake Couchiching.

WILMOT, S. 1892. Report of fish culture activities for 1891. Supplement No. 1, Annual Report of the Department of Fisheries, Dominion of Canada. Ottawa, Ontario.

In 1891, a total of 1,770,000 salmon (lake trout) fry were produced at the Newcastle hatchery and 999,000 fry were produced at the Ottawa hatchery. These fish were stocked in the Great Lakes (Erie, Huron, St Clair, Ontario) and inland waters of southern Ontario and western Québec. Inland waters of southern Ontario which were stocked included Big Rideau, Charleston, Sharbot, Couchiching, Sturgeon, Simcoe, Owl and Manatowaba.

WILTON, M. L. 1967. The Bark Lake fishery 1966. Resource Management Report No. 91. Ontario Department of Lands and Forests. Huntsville, Ontario. 6 p.

In 1965, a project was begun on Bark Lake in an effort to establish the influence of the Ontario Hydro winter drawdown on the natural reproduction of lake trout. During the first five years, 15,000 fin clipped lake trout yearlings will be stocked in the lake per year. During the second five year period (1970-1975 inclusive) intensive fall netting on the major spawning beds will be conducted to establish the ratio between hatchery and native fish.

WILTON, M. L. 1978. Lake trout in Bracebridge District. File Report. Ontario Ministry of Natural Resources. Bracebridge, Ontario. 7 p.

As follow-up to work conducted during the fall and winter of 1975-1976 and 1976-1977, this report deals with certain aspects of natural lake trout reproduction which were investigated during the fall and winter of 1977-78. Since only Mary and Bella lakes were involved this year this report will consist of a summary of findings.

During all observations in May Lake, an effort was made to identify fin-clipped (hatchery) fish. Since none were seen it is probably safe to assume that many of the adult lake trout in the lake are the result of natural spawning. As mentioned in notes (October 20), some apparent spawning activity was taking place in several feet of water. The spawn from such activity may survive in spite of drawdown – but I feel that this definitely represents a minority of the spawning activity in Mary Lake.

While it is virtually impossible to estimate losses due to drawdown, I feel that a significant amount of the lake trout spawn deposited in Mary Lake in 1977 was lost because of pre-freeze-up and post-freeze-up water drawdown patterns.

Under the conditions encountered during the winter of 1977-78 in Mary Lake, the ice and snow which cover the spawning shoals did not provide sufficient insulation to prevent the freezing of lake trout eggs during the "under-ice" drawdown period.

Under natural conditions of no drawdown, such as those encountered in Bella Lake, egg losses due to freezing appear to be almost non-existent.

In summary then I feel that during 1977-78 lake trout incubation period, eggs in 12 inches of water in Bella Lake survived, while eggs in 12 inches of water in Mary Lake did not – and this represents a significant percentage of the total egg production.

WILTZIUS, W. J. 1985. Fish culture and stocking in Colorado, 1872-1978. Division Report No. 12. Colorado Division of Wildlife. Denver, Colorado. 102 p.

Historic stocking records for Colorado waters are reviewed. The first recorded introduction of lake trout in Colorado occurred in 1879. Lake trout plantings have been conducted by both state and federal agencies in Colorado waters since 1886.

WISCONSIN DEPARTMENT OF NATURAL RESOURCES. 1999. An evaluation of stocking strategies in Wisconsin with an analysis of projected stocking needs. Bureau of Fisheries Management and Habitat Protection. Madison, Wisconsin. 37 p.

This report specifically addresses the long range stocking goals for the Department of Natural Resources and projected long term propagation needs using the best available scientific information. This plan promotes the most effective use of stocking in the overall management of Wisconsin's fisheries using a goal-oriented, species and waterbody specific approach that minimizes impacts to existing self sustained populations. The inland trout stocking program consists of stocking brook trout, brown trout, rainbow trout, lake trout and splake. Current and projected lake trout stocking demands are consistent at 145,000 fish.

WOLLINTZ, R. E. 1975. Southwest Virginia fisheries survey: Laurel bed lake trout stocking density evaluations. Virginia Commission of Game and Inland Fisheries. Richmond, Virginia. 4 p.

WOOTTEN, R. 1997. Health management in stocked fisheries. p. 235-244. *In* T. Petr [ed.]. Inland Fishery Enhancements. FAO Fisheries Technical Paper 374. Rome Italy.

This paper discusses the effects and control of disease in enhanced fisheries. Infectious and non-infectious causes of disease are given and the effects of disease, including direct mortalities as well as losses due to reduced growth, fecundity, product quality and social factors, as well as the costs of control measures are discussed. The importance of husbandry and environmental factors in the occurrence of disease outbreaks is highlighted and the impacts of the introduction of pathogens and the introduction of exotic fish species are described. Methods for the prevention of the introduction of pathogens are described including the use of quarantine procedures. The occurrence of disease in caged fish is assessed and methods of health management for both caged fish and those stocked in capture fisheries are described and discussed.

WRIGHT, B. H. and R. D. SOPUCK. 1979. A history of fish stocking in northern Manitoba. Manuscript Report 79-6. Fisheries Research, Manitoba Department of Mines, Natural Resources and Environment. Winnipeg, Manitoba. 70 p.

The past several decades have seen thousands of fry, fingerlings, yearlings or eggs planted into northern Manitoba waters to provide better sport fishing. This report has been prepared to be used as a reference on northern stocked waters. Stocking records are presented for 30 lakes, 3 pits and 6 streams and rivers. Lake trout stocking activity was recorded for ten lakes. Several of these involved supplemental stocking which, in retrospect, were of questionable value. In one instance (Cedar Lake) lake trout stocking was unsuccessful due to artificial water level fluctuations.

Overall, within the last ten years (post 1968), over one-half million trout (lake, brook, splake, rainbow) have been stocked in bodies of water where there were well established trout populations. The success of stocking in every case has been doubtful.

YOUNGS, W. D. and R. T. OGLESBY. 1972. Cayuga Lake: Effects of exploitation and introductions on the salmonid community. Journal of the Fisheries Research Board of Canada 29 : 787-794.

The dominant sport fishery in Cayuga Lake is for lake trout. The population is maintained by an annual stocking of 28,000 fish which are identified to year class by fin clip. There is virtually no natural reproduction in the lake as judged by fin clipped specimens taken by extensive sampling. The gill net catch of lake trout during the summer occurred predominantly between 13 and 30 m, commonly to 60 m, and sometimes to 75 m. During the fall there is a movement of mature lake trout to the area of Taughannock Point. Lake trout spawning takes place in 30-50 m of water but extends down to 74 m. The reasons for the failure of lake trout to reproduce naturally are not known but it is felt that heavy siltation in the spawning area causes eggs to suffocate. Winter distribution with regard to depth is quite general with specimens collected from depths of 4-58 m.

Food habits of the lake trout in Cayuga Lake are quite well defined. Smaller lake trout from 15 cm (average size at stocking) to 25 cm feed primarily on *Mysis* and occasionally on *Pontoporeia*, other invertebrates and small alewives. After the lake trout reach a length of about 25 cm the alewife becomes by far the most important food item especially during the summer months. Other fish species are utilized to a rather limited extent. Of these other species the sculpin (*Cottus* sp.), trout-perch (*Percopsis omiscomaycus*) and smelt are the most important. Smelt are utilized mainly during the spring of the year when surface waters are cool and smelt are gathered in areas of stream discharges prior to spawning.

ZIMMERMAN, F. A. 1965. The Lake Manitou 1962-1965 winter creel census. File Report. Ontario Department of Lands and Forests. Sudbury, Ontario. 4 p.

This report summarizes winter creel census data collected on Lake Manitou in 1963, 1964 and 1965 as well as summer creel surveys conducted in 1963 and 1964. Almost 90% of the lake trout in the 1965 winter creel survey were fin clipped. The majority of the marked lake trout observed during the winter of 1965 possessed a left ventral-adipose (AdLV) fin clip combination. Lake Manitou's fishery currently is sustained by introductions of hatchery stock.

ZIMMERMAN, F. A. 1967. The 1967 winter creel census on Lake Manitou, Manitoulin Island. File Report. Ontario Department of Lands and Forests. Sudbury, Ontario. 5 p.

To keep abreast of this important winter fishery, the creel census established in 1962 has been continued annually. This report covers our findings during the winter of 1967. Some 1,022 anglers fishing 4,681 hours caught 288 lake trout. The predominant year class was the 1963 plant (1962 year class) similar to that observed in the 1966 creel. In 1966, 71% of the fish caught were planted in 1963 while 41% of the 1967 fish caught were from the 1963 plant. That means that 63% of the lake trout caught in 1966 and 1967 were from the same hatchery year class. Nearly 75% of the trout taken in 1966 and 1967 came from the 1961 and 1962 year class of hatchery stock. Naturally produced fish contributed about the same number of fish to the creel each year (55 in 1966 and 65 in 1967) but the relative proportions to the total catch differed considerably. In 1966, 7.7% of the catch was from natural production while wild fish accounted for 22.5% in 1967. At the present time it is too early to determine the effects of the different planting rates although there appears to be an obvious difference in the success of different plantings.

ZIMMERMAN, F. A. 1968. Lake Manitou winter creel census, 1962-1968. File Report. Ontario Department of Lands and Forests. Sudbury, Ontario. 5 p.

From 1958 to 1962, the planting of yearling lake trout into Lake Manitou was approximately 10,000 fish per year on average. No trout were planted from 1953 to 1957. From 1962 to 1967, the plantings were increased to an average of 30,000 per year (10,000 in 1965). Nearly all of these fish were marked.

In the winter of 1968, 970 anglers were checked. These anglers fished for 4,600 hours to catch 1,386 fish of which 260 were lake trout. This indicates a marked change from the 125 anglers checked in 1962 who angled for 627 hours and took a total of 123 fish of which 55 were lake trout. The catch of lake trout has declined from 50 fish per 100 rod hours in 1963 to 5 fish per 100 rod hours in 1967. In view of the high percentage of hatchery fish in the anglers' catch (78% in 1968), the reduced catch-per-unit-effort in 1967 could be attributed to the reduced plant in 1965. It is felt that increase stocking of yearlings to between 50,000 and 75,000 fish is more in line with the need related to the present exploitation of lake trout on Lake Manitou.

Acknowledgements

We gratefully acknowledge the cooperation of biologists from various field offices across Ontario who responded to our survey and provided unpublished data and file reports of stocking assessment projects. We also thank colleagues in other provinces and states who provided stocking policies and guidelines from the respective jurisdictions. Ola McNeil and Wendy Stott provided historic fish stocking records. Margaret Wells and Elizabeth Gustafsson were extremely helpful during our literature search at the MNR corporate library in Peterborough. Charlie Olver is thanked for his technical review and constructive comments. Tracy Wakefield assisted in the final formatting of this document.

Subject Key

1.0 General References

- 1.1 Stocking policies and objectives
- 1.2 Reports of stocking activities
- 1.3 Introductions and transfers

2.0 Stocking Guidelines

- 2.1 General
- 2.2 Time of stocking
- 2.3 Stocking rates
- 2.4 Age/size of fish
- 2.5 Marking fish
- 2.6 Diseases and parasites
- 2.7 Fish community in stocked waters
- 2.8 Transport and release techniques
- 2.9 Genetic considerations
- 2.10 Physical/chemical requirements of stocked waters
- 2.11 Stocking site

3.0 Stocking Assessment

- 3.1 General
- 3.2 Assessment projects
- 3.3 Post-stocking survival
- 3.4 Returns to fishery
- 3.5 Physiology of stocked fish
- 3.6 Behaviour of stocked fish
- 3.7 Growth of stocked fish
- 3.8 Movements of stocked fish
- 3.9 Food habits of stocked fish
- 3.10 Maturation of stocked fish
- 3.11 Reproduction of stocked fish
- 3.12 Contribution to spawning stocks
- 3.13 Hybridization of stocked fish
- 3.14 Impacts of stocked fish
- 3.15 Susceptibility to predation

Subject Index

1.0 General References

1.1 Stocking Policies and Objectives

American Fisheries Society (Undated)
Chapple (1983)
Chiotti (1980)
Coates (1997)
Cuenco et al. (1993)
Dolson (1989)
Fry (1939)
Hamilton (1979)
Hickley (1993)
Kummu and Sormunen (1974)
Murray (1979)
Olver (1973)
Olver et al. (1991)
OMNR (1995)
OMNR/OMOE (1993)
Plosila (1977)
Smallwood (1918)
Vermont Department of Fish and Wildlife (1990)
Walter et al. (1986)
Warfel and Morrill (1939)
Weir (1951)
White et al. (1995)
Wisconsin Department of Natural Resources (1999)

1.2 Reports of Stocking Activities

Amtstaetter (1999)
Anonymous (1885) (1889$_a$) (1890) (1892) (1901) (1940) (1952) (1953) (1959) (1962) (1964) (1965$_a$) (1965$_b$) (Undated$_i$)
Auclair (1976)
Brett (1938)
Bridges and Hambly (1971)
Butler (1950)
Chalk and Stokes (1978$_a$)
Chapple (1984$_a$)
Crossman (1995)
Doan (1937)
Doan and Kennedy (1937)
Dominion of Canada (1892)
Gray and Maraldo (1981)
GS Environmental Services (2000)
Gunn (1980)
Heckart and Roguski (1966)
Heidinger (1999)
Holmes (1966)
Hutchinson (1981)
Jensen and Chen (1986)
Jorgensen (1971)
Kooyman (1971)
Lambert and Pross (1967)
Lauer (1983)
Lawrence (1907)
Loftus (1985)
MacLean and Hooper (1981)
Marshall and Johnson (1971)
Martin (1953)
McCrimmon (1956) (1967)
McCrimmon and Skobe (1970)
McKeown (Undated)
Meehan (1897)
Miller and Alcorn (1943)
Monroe and Hicks (1985)
Mutenia et al. (1982)
Nolting (1958) (1963)
Olver (1968)
OMNR (1989)
Patrick (1965)
Popov and Low (1953)
Shebley (1917)
Sly and Widmer (1984)
Spetz (1969)
Stockell (1955)
Sunde (1968)
Tompkins (1956)
Veale (1892)
Ward (2000)
Welcomme (1988)
Wilmot (1888) (1892)
Wilton (1967)
Wiltzius (1985)
Wright and Sopuck (1979)

1.3 Introductions and Transfers

Butler (1950)
Casselman (1987)
Charlton (1967)
Coates (1997)
Cowx (1994)
Crossman (1995)
Evans and Olver (1995)
Fuller et al. (1999)
Gerlach (1967)
Gönczi and Nilsson (1983)
Hall (1969)
Harrison (1969) (1970)
Hickley (1993)
Hutchins and Samis (1986)

Introductions (cont'd)
- Hutchinson (1981)
- Kerr (1977)
- Krueger and May (1991)
- La Rivers (1962)
- Leary et al. (1995)
- Mantle (1967)
- Marshall and Johnson (1971)
- Miller and Alcorn (1943)
- Mutenia et al. (1982)
- Nilsson and Svardson (1968)
- Olver and Lewis (1977)
- OMNR (1989)
- Popov and Low (1953)
- Purych (1976$_a$) (1980)
- Schraeder (1983)
- Shelby (1917)
- Soldwedel (1978)
- Thomas (1979)
- Tompkins (1956)
- Wiltzius (1985)

2.0 Stocking Guidelines

2.1 General
- Anonymous (Undated$_e$)
- Cowx (1994)
- Cronin (1979)
- Deyne (1990$_a$) (1990$_b$)
- Grimm (1983)
- Hynes et al. (1981)
- Maine Department Inland Fisheries and Wildlife (2000)
- Michigan Department Natural Resources (1987)
- Minnesota Department Natural Resources (1982)
- New York Department Environmental Conservation (1979)
- OMNR (1976) (1982) (1991) (2000$_a$)
- Québec Ministère du Loisir, de la Chasse et de la Pêche (1988)

2.2 Time of Stocking
- Anderson (1962)
- Bean (1916)
- McMurtry (Undated)

2.3 Stocking Rates
- Casselman (1986)
- Hacker (1962)
- Keil (1938)
- Michigan Department Natural Resources (1987)
- Minnesota Department Natural Resources (1982)
- New York Department Environmental Conservation (1979)
- OMNR (1982) (2000$_a$)
- Pellegrini (1992)
- Québec Ministère du Loisir, de la Chasse et de la Pêche (1988)
- Woolintz (1975)

2.4 Age/Size of Fish
- Anonymous (1971) (1972)
- Bentley (1950)
- Chevalier (1977)
- Greene (1955)
- Gunn et al. (1987)
- Hoff and Newman (1995)
- Machniak (1975)
- McMurtry (Undated)
- Nevin (1892)
- Plosila (1971) (1977)
- Prydie (1991)
- Schuler (1969)
- Shupp (1973)

2.5 Marking Fish
- Armstrong (1947)
- Bandow (1987)
- Eschmeyer (1959)
- Kincaid and Calkins (1992)
- Ostergaard (1982)
- Shetter (1951) (1952)

2.6 Diseases and Parasites
- Allison (1963)
- Goede (1986)
- McAllister and Herman (1989)
- Mitchum and Sherman (1981)
- Paine (1986$_a$)
- Wootten (1997)

2.7 Fish Community in Stocked Waters
- Anonymous (Undated$_d$) (1889$_b$)
- Bishop (1992)
- European Inland Fisheries Advisory Commission (1982)
- Evans and Olver (1995)

2.7 Fish Community in Stocked Waters (cont'd)
- Gunn et al. (1987)
- Hoyle (1990)
- McMurtry (Undated)
- Powell et al. (1986)
- Rawson (1945)
- Siesennop (1992)

2.8 Transport and Release Techniques
- Berka (1986)
- Black (1955)
- Cuerrier (1952)
- McDonald and Wood (Undated)
- OMNR (2000$_b$)
- Patrick (1960)
- Rayner (1940)
- Robinson (1990)
- Rupert et al. (1980)
- Van Wyck (1957)

2.9 Genetic Considerations
- Anonymous (1971) (1972)
- Hicks (1976)
- Hoyle (1990)
- Kapuscinski and Jacobson (1987)
- Kincaid (1995)
- Kincaid et al. (1993)
- Miller and Kapuscinski (In press)
- OMNR (1999)
- Paine (1986$_b$)
- Penman and McAndrew (1997)
- Plosila (1970) (1971) (1977)
- Siesennop (1992)
- Stickney (1994)

2.10 Physical/Chemical Requirements of Stocked Waters
- Anonymous (1970)
- Evans and Olver (1995)
- Gunn and Mills (1998)
- Gunn et al. (1987)
- Liimatainen (1983)
- Marshall and Johnson (1971)
- Martin and Olver (1976)
- McAfee (1966)
- Odell and Senning (1937)
- OMNR (1982)

2.11 Stocking Site
- Anonymous (1951)
- Bean (1916)
- Casselman (1986) (1987)
- Eaton (1928)
- Keil (1938)
- Kendall (1924)
- Weir (1951)

3.0 Stocking Assessment

3.1 General
- Alexander (1970)
- Anonymous (1932) (1990) (Undated$_g$) (Undated$_h$)
- Baldwin (1950)
- Brewer (1970)
- Chapple (1981$_a$) (1981$_b$) (1981$_d$) (1981$_e$)(1982$_a$) (1982$_b$) (1982$_c$) (1982$_d$) (1983$_a$) (1983$_b$) (1984$_a$) (1984$_b$) (1984$_c$)
- Charlton (1967)
- Cheney (1885)
- Dunlop and Brady (1995) (1997)
- Hassinger and Woods (1974)
- Holloway (1945)
- Jorgensen (1968)
- Kooyman (1971)
- Lambert and Pross (1967)
- Littkemann (1960)
- Martin and Fry (1972)
- Nesler (1981)
- Noakes and Curry (1995)
- OMNR (1973)
- Orendorff and Fraser (1984)
- Stokes and Chalk (1978)
- Thomas (1994)
- Waring (1985)
- Webster (1950) (1955) (1959$_a$) (1959$_b$)
- Webster et al. (1959)

3.2 Assessment Projects
- Anonymous (Undated$_d$)
- Armstrong (1949) (1950) (1951) (1952)
- Belfry (1997) (1998$_a$)
- Black (1986)
- Blake (1987$_a$) (1987$_b$)
- Casselman (1987)
- Chalk and Stokes (1978$_b$) (1978$_c$)
- Chapple (1981$_a$) (1981$_b$) (1981$_c$) (1983)

Assessment Projects (cont'd)

Coombs (2000)
Deary Environmental Consultants (1990)
Eckersley and MacIntosh (1976)
Gerri (1986)
Hamill (1995) (1998)
Haxton (1991)
Irvine (1965)
Jacob (1964)
Kerr (1997)
Liimatainen (1983)
Livingstone (1990)
MacIntosh and Eckersley (1976_a) (1976_b) (1976_c)
McGaughey (1994)
McKnight (1977)
McLeish (1991)
Miller (Undated)
Olver (1972_b)
Pellegrini (1992)
Powell et al. (1986)
Prydie (1991)
Purych (1977_a)
Rawson (1945)
Sadowsky (1998)
Shupp (1973)
Snucins (1983) (1986)
Thomas, E. (1979)
Thomas, B. (1998_a) (1998_b) (1998_c) (1998_d) (1999)
Thurston (1976) (1977)
Trepanier and Prior (1979_a) (1979_b) (1979_c) (1979_d) (1979_e)

3.3 Post-Stocking Survival

Budd et al. (1968)
Chalk and Stokes (1978_a)
Gunn and Keller (1981) (1984)
Haskell et al. (1952)
Hoyle (1990)
Ihseen et al. (1982)
Purych (1976_b)
Snucins (1992)
Taub (1963)
Trepanier and Maw (1978)
Trepanier and Prior (1979_a)
Turner (1972)
Webster (1958)

3.4 Returns to Fishery

Anonymous (Undated $_a$) (Undated $_b$) (Undated $_c$) (Undated $_f$) (1970) (1976) (1983) (1986) (1987_a) 1987_b)
Armstrong (1950) (1951) (1952)
Arndt (1989)
Barnes (1982)
Barnes et al. (1984)
Beange (1974) (1976_a) (1976_b) (1978)
Belfry (1998_b)
Bradbury (1979)
Brown (1981)
Burris (1985)
Burris and Brisbane (1985)
Burris et al. (1985)
Cerutti and Gillespie (1965)
Chalk and Stokes (1978_a)
Cheley (1970)
Clark (1972)
Claytor et al. (1985)
Desjardine and Lawrence (1979)
Diebolt (1982)
Evans (1992)
Gerlach (1963) (1967)
Gibson (1968)
Gillap (1983)
Hall (1969)
Hicks (1982) (1985)
Himburg (1971)
Holye (1990)
Hoyle and MacLean (1988)
Hughson (1965) (1966)
Irwin (1983) (1985) (1989)
Irwin and Brisbane (1988)
Jorgensen (1971) (1973_b)
Kerr (1980) (1981_b) (1982) (1983) (1985) (1986) (1991) (1992) (1999)
Kilby (1982)
Krishka (1995)
Lafferty (1980)
Lauer (1983)
Lemke (1975)
Liimatainen et al. (1987)
Loftus (1982)
Loftus and Rubie (1982)
MacDonald and Hartley (1988)
Matz (1971)
McGurrin (1977)
McKeown (1970) (1974)
McKnight (1977)

Returns to Fishery (cont'd)
- Murphy (1970)
- Olver (1967) (1970) (1971$_{a}$)
  (1971$_{b}$) (1971$_{c}$)
  (1971$_{d}$) (1971$_{e}$)
  (1971$_{f}$) (1972$_{a}$)
- Overholt (1977)
- Palilionis (1978$_{a}$) (1978$_{b}$)
  (1979)
- Purych, N. (1973)
- Purych, P. (1970) (1971)
  (1975$_{b}$) (1976$_{b}$)
  (1977$_{b}$)
- Raine (1970) (1975)
- Read (1981)
- Read et al. (1975)
- Renaud (1980)
- Ridout (1981)
- Rubie (1983)
- Salar (1985)
- Samis (1968$_{a}$) (1968$_{b}$)
- Schlesinger and MacLean
  (1983)
- Sheehan et al. (1977)
- Stewart, C. (1995)
- Stewart, T. (1987)
- Sly and Widmer (1984)
- Sutherland and Lawrence (1978)
- Swainson (1980) (1981)
- Von Geldern and Kabel (1960)
- Walker (1979)
- Zimmerman (1965) (1967)
  (1968)

3.5 Physiology of Stocked Fish
- Black (1955)
- Durant et al. (Undated)
- McDonald and Robinson (1993)
- McDonald et al. (1993)
- McDonald and Wood (Undated)
- Poynter (1976)

3.6 Behaviour of Stocked Fish
- Medina (1993)
- Nilsson and Svardson (1968)
- Nolting (1958)

3.7 Growth of Stocked Fish
- Gerlach (1967)
- Gönczi and Nilsson (1983)
- Hacker (1962)
- Harrison (1970)
- Haskell (1952)
- Haskell et al. (1952)
- Hoyle (1990)
- Ihssen et al. (1982)
- MacLean et al. (1981)
- Soldwedel (1978)
- Turner (1972)
- Webster (1958)

3.8 Movements of Stocked Fish
- MacLean et al. (1981)

3.9 Food Habits of Stocked Fish
- Anonymous (1983)
- Gerlach (1967)
- Griest (1977)
- Gunn (1980)
- Hacker (1957) (1962)
- Loftus (1982)
- Machniak (1975)
- Martin (1966)
- Moore (1984)
- Nilsson and Svardson (1968)
- Purych (1973)
- Soldwedel (1978)
- Webster (1958)
- Youngs and Oglesby (1972)

3.10 Maturation of Stocked Fish
- Desjardine (1979)
- Dosser (1988) (1989)
- Dosser and Brisbane (1987)
- Ferguson (1978)
- Gerlach (1962)
- Hacker (1958)

3.11 Reproduction of Stocked Fish
- Casselman (1987)
- Griest (1977)
- Harrison (1969)
- Henderson (1982)
- Hitchins and Samis (1986)
- La Rivers (1962)
- Mantle (1967)
- Olver and Lewis (1977)
- Polkinghorne (1983)
- Purych (1975$_{a}$) (1976$_{a}$) (1980)
- Schraeder (1983)

3.12 Contribution to Spawning Stocks
- Amtstaetter (1999$_{b}$)
- Desjardine (1979)
- Dosser (1987) (1989)
- Dosser and Brisbane (1987)
- Ferguson (1978)
- Flowers (1984)
- Gerlach (1962)

3.12 Contribution to Spawning Stocks (cont'd)

- Henderson (1982)
- Hoyle (1990)
- Jacob (1964)
- Kerr (1981$_a$) (1999)
- MacLean et al. (1981)
- McMurtry (1989)
- Perron (1984)
- Stanfield (1982)
- Walker (1979)
- Wilton (1978)
- Youngs and Oglesby (1972)

3.13 Hybridization of Stocked Fish

- Hindar et al. (1991)
- Kerr and Grant (2000)
- Leary et al. (1995)
- Marnell (1986)

3.14 Impacts of Stocked Fish

- Evans et al. (1991)
- Evans and Willox (1991)
- Fuller et al. (1999)
- Hindar et al. (1991)
- Kerr and Grant (2000)
- Krueger and May (1991)
- La Rivers (1962)
- Marnell (1986)

3.15 Susceptibility to Predation

- Krueger and Shepherd (1997)

APPENDIX 1. Lake trout stocking in Ontario inland waters, 1880-1999. Information has been obtained from a number of sources including Annual Reports of the Department of Fisheries and Ontario Department of Lands and Forests (pre 1946), OFIS fish stocking records (1947-1994), and MNR Fish Culture records (1994-1999).

Number of Fish Stocked

Year	Eyed Eggs	Fry	Fingerlings	Yearlings	Juvenile-Adults	Unknown	Total
1880	-	40,000	-	-	-	-	40,000
1887	-	770,000	-	-	-	-	770,000
1888	-	1,400,000	-	-	-	-	1,400,000
1889	-	760,000	-	-	-	-	760,000
1890	-	1,300,000	-	-	-	-	1,300,000
1891	-	1,624,000	-	-	-	-	1,624,000
1892	-	1,110,000	-	-	-	-	1,110,000
1893	-	2,180,000	-	-	-	-	2,180,000
1894	-	1,530,000	-	-	-	-	1,530,000
1895	-	1,270,000	-	-	-	-	1,270,000
1896	-	710,000	-	-	-	-	710,000
1897	-	885,000	-	-	-	-	885,000
1898	-	-		No Information Available		-	-
1899	-	1,130,000	-	-	-	-	1,130,000
1900	-	1,295,000	-	-	-	-	1,295,000
1901	-	1,120,000	-	-	-	-	1,120,000
1902	-	830,000	-	-	-	-	830,000
1903	-	1,151,000	-	-	-	-	1,151,000
1904	-	800,000	-	-	-	-	800,000
1905	-	825,000	-	-	-		825,000
1906	-	-		No Information Available		-	-
1907	-	-		No Information Available		-	-
1908	-	1,024,000	-	-	-	-	1,024,000
1909	-	890,000	-	1,500	-	-	891,500
1910	-	915,000	-	-	-	-	915,000
1911	-	-		No Information Available		-	-
1912	-	-		No Information Available		-	-
1913	-	-		No Information Available		-	-
1914	-	100,000	-	-	-	-	100,000
1915	-	460,000	-	-	-	-	460,000
1916	-	500,000	50,000	-	-	-	550,000
1917	-	1,120,000	-	-	-	-	1,120,000
1918	-	990,000	-	-	-	-	990,000
1919	-	1,050,100	-	-	-	-	1,050,100
1920	-	1,334,000	-	-	-	-	1,334,000
1921	-	110,400	-	-	-	-	110,400
1922	-	5,205,000	-	-	-	-	5,205,000
1923	-	6,040,100	-	-	-	-	6,040,100
1924	-	7,421,000	-	-	-	-	7,421,000
1925	-	5,749,000	-	-	-	-	5,749,000
1926	-	4,455,000	-	-	-	-	4,455,000
1927	-	3,205,000	-	-	-	-	3,205,000
1928	-	3,480,000	-	-	-	-	3,480,000
1929	-	3,176,000	-	-	-	-	3,176,000
1930	-	1,191,500	2,917,800	-	-	-	4,109,300

Year	Eyed Eggs	Fry	Fingerlings	Yearlings	Juvenile-Adults	Unknown	Total
1931	-	685,000	-	-	-	-	685,000
1932	-	20,000	-	350	-	-	20,350
1933	200.000	1,400,000	7,487,700	-	-	-	9,087,700
1934	-	1,265,000	977,700	-	-	-	2,242,700
1935	-	1,120,000	2,553,000	-	-	-	3,673,000
1936	-	378,000	3,464,000	-	-	-	3,842,000
1937	-	960,000	2,373,250	-	-	-	3,333,250
1938	-	890,000	3,040,700	-	-	-	3,930,700
1939	-	2,279,900	2,367,700	-	-	-	4,647,600
1940	-	1,450,000	3,036,100	-	-	-	4,486,100
1941	-	837,250	3,160,900	-	-	-	3,998,150
1942	-	217,000	3,775,100	10,680	-	-	4,002,780
1943	-	25,000	1,846,800	60,860	-	-	1,932,660
1944	-	416,500	1,250,995	44,018	-	-	1,711,513
1945	-	-	1,917,900	88,700	-	-	2,006,600
1946	-	5,000	962,595	23,545	-	-	991,140
1947	-	107,500	902,000	112,350	-	8.500	1,130,350
1948	-	28,600	494,100	43,255	-	-	565,955
1949	500,000	616,000	1,000,800	43,800	-	4,000	2,164,600
1950	-	24,000	1,426,900	21,760	-	1,000	1,473,660
1951	-	541,800	809,100	73,377	6,000	-	1,430,277
1952	-	221,000	1,358,880	108,075	-	-	1,687,955
1953	-	144,000	2,523,810	140,700	-	24,200	2,832,710
1954	-	-	569,100	204,500	-	5,000	778,600
1955	-	38,460	566,900	71,500	-	6,600	683,460
1956	11,725	8,000	174,500	199,750	-	1,200	395,175
1957	-	-	109,500	9,500	-	-	119,000
1958	4,800	-	184,600	223.304	4.000	-	416,704
1959	-	36,000	133,900	85,050	-	-	254,950
1960	-	44,800	89.100	153,550	15	-	287,465
1961	-	18,500	153,800	212.190	8,278	-	392,768
1962	-	3,000	129,250	320,152	671	-	453,073
1963	-	-	88,100	418,290	1,600	-	507,990
1964	-	-	690	376,418	435	-	377,543
1965	-	-	207,800	238,700	1,647	-	448,147
1966	-	11,900	207,000	707,780	430	19,700	946,810
1967	-	42,000	185,390	499,894	4,763	2,950	734,997
1968	-	17,480	97,000	621,410	6,209	19,250	761,349
1969	-	-	-	451,820	7.226	-	459,046
1970	-	-	38,760	502.694	8.737	7.900	558,091
1971	-	-	95,920	856,220	10,000	-	962,140
1972	-	-	15,000	836,335	18,675	1.100	871,110
1973	-	-	2,500	748,780	41,322	1.000	793,602
1974	-	-	-	1,129,704	32,776	10,000	1,172,480
1975	-	-	-	543,741	101,425	14,000	659,166
1976	-	-	11.996	1,106,081	114,670	2.500	1,235,247
1977	-	-	240,441	919,468	90,483	-	1,250,392
1978	120,000	-	700	737,642	82,741	-	941,083
1979	120,000	-	10,000	762,057	10,000	-	902,057
1980	-	-	10,000	638,415	49,064	3,500	700,979
1981	-	-	8,800	835.336	21,805	7,600	873,541

Year	Eyed Eggs	Fry	Fingerlings	Yearlings	Juvenile-Adults	Unknown	Total
1982	-	-	10.000	811.984	2.107	-	824,091
1983	25,000	-	40.000	632.562	3.977	-	701,539
1984	80,250	-	3,050	1,169,603	13,300	-	1,266,203
1985	38,000	-	-	1,315,039	31.300	-	1,384,339
1986	15,000	-	16.300	787,628	3.505	-	822,433
1987	224.125	-	73.861	1,366,830	6,452	-	1,671,268
1988	378.000	200,000	844,577	1,180,793	8.299	-	2,611,669
1989	193.000	-	531,300	1,393,909	12,481	2,000	3,779,690
1990	400.000	831,000	669,944	1,285,217	2.350	-	3,188,511
1991	292.300	330,000	309,995	1,688,935	9.312	-	2,630,542
1992	60,374	303,000	194,764	861.031	8.090	7,753	1,435,012
1993	110.000	426,000	310,300	509.530	400	-	1,356,230
1994	660.000	115,000	12.000	644.035	3.605	-	1,434,640
1995	765.000	251,520	-	893,397	10,389	-	1,920,306
1996	100.000	71,000	-	723,851	5.836	-	900,687
1997	810.000	689,233	-	727,620	4.933	-	2,231,786
1998	547.000	269,526	82.474	668.626	10,400	-	1,578,026
1999	996.161	162,950	40.000	940.430	4.416	-	2,143,957

OFIS - Ontario Fisheries Information System

APPENDIX 2. Introductions of lake trout in Ontario waters which have established self-sustaining populations.

Lake	Latitude	Longitude	Year of Introduction	Reference(s)
Almonte	47° 43'	84° 42'	-	OMNR (1989)
Axe	46° 29'	83° 25'	-	OMNR (1989)
Bobowash	46° 34'	82° 47'	1972	Hitchins and Samis (1986), OMNR (1989), Evans and Olver (1995)
Buck (McCann)	45° 41'	79° 10'	-	OMNR (1989)
Cauliflower (Clydawadka)	45° 24'	78° 15'	-	OMNR (1989)
Cherie	47° 00'	83° 43'	-	OMNR (1989)
Clearwater	44° 48'	79° 14'	-	OMNR (1989)
Cliff	49° 03'	88° 47'	-	OMNR (1989)
Conacher (Caribou)	46° 40'	83° 30'	-	OMNR (1989)
Cosgrove	49° 14'	87° 56'	1968	Schraeder (1983)
Crystal	46° 43'	82° 48'	-	OMNR (1989)
Cut	46° 46'	79° 16'	-	OMNR (1989)
Dollyberry	46° 33'	82° 47'	1972	Hitchins and Samis (1986), Evans and Olver (1995)
Duborne	46° 15'	82° 55'	-	OMNR (1989)
Duval	46° 43'	83° 04'	1975	Hitchins and Samis (1986), OMNR (1989), Evans and Olver (1995)
Elbow	46° 32'	83° 01'	-	OMNR (1989)
Ezma	46° 33'	82° 50'	1973	Hitchins and Samis (1986), OMNR (1989), Evans and Olver (1995)
Fassett	46° 01'	79° 06'	-	OMNR (1989)
Fearless	48° 37'	85° 43'	-	OMNR (1989)
Finn	46° 43'	83° 10'	-	OMNR (1989)
Fortune	48° 36'	81° 54'	-	OMNR (1989)
Fralek	46° 55'	80° 53'	-	OMNR (1989)
Galer	48° 02'	80° 30'	-	OMNR (1989)
Gamitagama	47° 39'	84° 46'	1961	Olver and Lewis (1977), OMNR (1989), Evans and Olver (1995)
Gibberry	46° 32'	84° 48'	1972	Hitchins and Samis (1986), Evans and Olver (1995)
Gliskning (Joe)	45° 31'	78° 13'	-	OMNR (1989)
Helen	47° 01'	81° 06'	-	OMNR (1989)
Hilltop	47° 54'	84° 49'	-	OMNR (1989)
Hogsback	48° 19'	82° 27'	-	OMNR (1989)
Horner (Stoney)	46° 40'	83° 32'	1969	Purych (1976_a) (1980), OMNR (1989), Evans and Olver (1995)
Horseshoe	46° 42'	83° 04'	1975	Hitchins and Samis (1986), OMNR (1989), Evans and Olver (1995)
Hyphen	46° 32'	82° 47'	-	OMNR (1989)
Jessie	49° 12'	88° 21'	-	OMNR (1989)
Kabiskagami	48° 41'	84° 34'	-	OMNR (1989)
Katzenbach	48° 04'	85° 20'	-	OMNR (1989)

Lake	Latitude	Longitude	Year of Introduction	Reference(s)
Kennedy	46° 51'	81° 50'	-	OMNR (1989)
Kenny	48° 46'	87° 43'	-	OMNR (1989)
Kirk	46° 40'	83° 05'	-	OMNR (1989)
Leg of Lamb	48° 34'	80° 52'	-	OMNR (1989)
Little Panache	46° 17'	81° 22'	-	OMNR (1989)
Lost Canoe	46° 34'	82° 46'	-	OMNR (1989)
Mair (Green)	45° 07'	76° 50'	-	OMNR (1989)
Mamainse	47° 03'	84° 37'	-	OMNR (1989)
Mashagama	46° 55'	83° 21'	1971	Hitchins and Samis (1986), Evans and Olver (1995)
McMahon (Island)	46° 32'	84° 48'	-	OMNR (1989)
Mijinemungshing	47° 42'	84° 42'	1966	Thomas (1979), OMNR (1989)
Mishi	48° 05'	85° 21'	1963	Harrison (1969), OMNR (1989)
Mishibishu	48° 05'	85° 25'	1958	Harrison (1969), OMNR (1989)
Miskwabi (Misquabinish)	45° 03'	78° 19'	-	OMNR (1989)
Mystery (South Anvil)	47° 03'	83° 32'	-	OMNR (1989)
Murray	45° 10'	76° 31'	-	OMNR (1989)
Muskrat (Cobden)	45° 40'	76° 55'	-	OMNR (1989)
Napier	45° 12'	76° 36'	-	OMNR (1989)
North	45° 43'	79° 12'	-	OMNR (1989)
Old Woman	47° 37'	84° 43'	-	OMNR (1989)
Onedee (Elbow)	46° 40'	83° 09'	-	OMNR (1989)
Panache	46° 15'	81° 20'	-	OMNR (1989)
Path	47° 00'	81° 40'	-	OMNR (1989)
Pogamasing	46° 59'	81° 50'	-	OMNR (1989)
Red rock	47° 43'	84° 48'	-	OMNR (1989)
Robb	46° 41'	83° 09'	-	OMNR (1989)
Samreid	46° 34'	82° 45'	1971	Hitchins and Samis (1986), OMNR (1989), Evans and Olver (1995)
Sand	47° 45'	84° 31'	-	OMNR (1989)
Sesabic	46° 58'	83° 22'	1971	Hitchins and Samis (1986), OMNR (1989), Evans and Olver (1995)
Smith	49° 54'	82° 00'	-	OMNR (1989)
Survey	46° 39'	82° 42'	-	OMNR (1989)
Toodee	46° 45'	83° 10'	1971	Hitchins and Samis (1986), OMNR (1989), Evans and Olver (1995)
Wanapitei	46° 45'	80° 45'	-	OMNR (1989)

APPENDIX 3. Contribution of stocked lake trout to selected recreational fisheries. Creel surveys having a sample size of less than ten fish were not included.

Lake	Season/Year	% Stocked Fish in Catch	Reference(s)
Ashby (Ontario)	Winter (1991)	75.0% (N=12)	Kerr (1991)
Anstruther (Ontario)	Spring (1980)	0.0% (N=10)	OFIS records
	Early summer (1982)	0.0% (N=52)	Rubie (1983)
	Winter (1983)	10.0%	Irwin (1983)
	Summer-Fall (1983)	1.8% (N=112)	Irwin et al. (1985)
	Spring-Summer (1987)	5.1% (N=78)	Irwin (1989)
	Summer (1988)	20.1% (N=139)	OFIS records
	Summer (1989)	4.1% (N=122)	OFIS records
	Summer (1990)	17.2% (N=87)	OFIS records
	Summer (1991)	17.9% (N=134)	OFIS records
Bark (Ontario)	Summer (1976)	52.8% (N=127)	Hicks (1985)
	Summer (1977)	64.8% (N=105)	Hicks (1985)
	Summer (1979)	39.2% (N=130)	Hicks (1985)
	Summer (1980)	26.7% (N=60)	Hicks (1985)
	Summer (1983)	69.1% (N=68)	Anonymous (1987$_b$)
	Winter (1984)	65.9% (N=41)	Anonymous (1987$_b$)
Barker (Ontario)	Winter (1991)	13.6% (N=22)	Kerr (1991)
Bay (Ontario)	Winter (1984)	27.0% (N=26)	Salar (1985)
	Spring (1985)	17.0%	Burris and Brisbane (1985)
	Summer (1986)	46.2% (N=13)	Irwin (1989)
	Summer (1987)	60.0%	Anonymous (1987)
Bella (Ontario)	Winter (1991)	74.0% (N=52)	OMNR file data
Bernard (Ontario)	Winter (1993)	100.0% (N=38)	OFIS records
Big Clear (Ontario)	Winter (1981)	35.7% (N=56)	OFIS records
	Winter (1982)	55.6% (N=36)	Schlesinger and MacLean (1983)
	Winter (1983)	55.3% (N=38)	Barnes et al. (1985)
	Winter (1984)	44.1% (N=68)	Claytor et al. (1985)
	Winter (1985)	45.7% (N=46)	OFIS records
	Winter (1986)	43.3% (N=90)	OFIS records
Big Hawk (Ontario)	Summer and Winter (1979)	12.5%	Bradbury (1979)
Big Rideau (Ontario)	Winter (1970)	6.8% (N=161)	Raine (1970)
	Winter (1971)	16.7% (N=107)	Raine (1975)
	Summer (1971)	17.6% (N=51)	Clark (1972)
	Winter (1974)	73.8% (N=111)	Lemke (1975)
	Winter (1975)	86.7% (N=90)	Raine (1975)
	Summer (1976)	86.8% (N=38)	OMNR file data
	Winter (1977)	54.8% (N=124)	OMNR file data
	Summer (1977)	29.0% (N=31)	OMNR file data

Lake	Season/Year	% Stocked Fish in Catch	Reference(s)
Big Rideau (cont'd)	Winter (1981)	66.7% (N=30)	OFIS records
	Summer (1981)	52.9% (N=51)	OFIS records
	Winter (1982)	51.7% (N=58)	Schlesinger and MacLean (1983)
	Winter (1983)	68.6% (N=51)	Barnes et al. (1984)
	Summer (1983)	60.0% (N=50)	Barnes et al. (1984)
	Winter (1984)	65.9% (N=41)	Claytor et al. (1984)
	Winter (1985)	50.0% (N=50)	OFIS records
	Summer (1985)	51.1% (N=45)	OFIS records
	Winter (1986)	30.7% (N=88)	OFIS records
	Summer (1989)	71.3% (N=101)	OFIS records
Big Salmon (Ontario)	Winter (1981)	46.4% (N=28)	OFIS records
	Winter (1982)	62.1% (N=29)	Schlesinger and MacLean (1983)
	Winter (1983)	68.3% (N=60)	Barnes et al. (1983)
	Winter (1984)	58.8% (N=51)	OFIS records
	Winter (1985)	48.0% (N=50)	OFIS records
	Winter (1986)	41.8% (N=67)	OFIS records
	Summer (1992)	13.8% (N=29)	OFIS records
	Summer (1995)	4.6% (N=44)	OFIS records
Blackstone (Ontario)	Winter (1977)	68.8%% (N=48)	Unpublished data
	Winter (1978)	69.4% (N=49)	Unpublished data
Brule (Ontario)	Winter (1991)	50.0% (N=32)	Kerr (1991)
	Winter (1992)	56.5% (N=69)	Kerr (1992)
Buzzard (Ontario)	Winter (1992)	57.9% (N=19)	OFIS records
Camp (Ontario)	Winter (1990)	80.0% (N=23)	OMNR file data
Chandos (Ontario)	Winter (1983)	15.7% (N=223)	OFIS records
	Summer (1983)	0.0% (N=14)	OFIS records
	Summer (1987)	25.0% (N=12)	OFIS records
	Summer (1988)	38.5% (N=52)	OFIS records
Charleston (Ontario)	Summer (1968)	35.6% (N=92)	Raine (1975)
	Winter (1970)	73.2% (N=198)	Raine (1970)
	Summer (1970)	30.0% (N=50)	Murphy (1970)
	Winter (1971)	60.7% (N=395)	Raine (1975)
	Winter (1973)	68.8% (N=48)	Unpublished data
	Winter (1974)	57.5% (N=440)	Lemke (1975)
	Winter (1975)	44.2% (N=242)	Raine (1975)
	Winter (1977)	55.0% (N=120)	Overholt (1977)
	Summer (1977)	67.6% (N=68)	McGurrin (1977)
	Winter (1978)	42.9%	Unpublished data
	Winter (1980)	48.8% (N=84)	Brown (1980)
	Winter (1981)	51.7% (N=60)	OFIS records
	Summer (1981)	48.3% (N=58)	OFIS records
	Winter (1982)	48.0% (N=50)	Schlesinger and MacLean (1983)

Lake	Season/Year	% Stocked Fish in Catch	Reference(s)
Charleston (cont'd)	Winter (1983)	56.0% (N=50)	Anonymous (Undated$_f$)
	Summer (1983)	48.8% (N=82)	OFIS records
	Winter (1984)	68.2% (N=44)	Claytor et al. (1985)
	Winter (1985)	68.9% (N=45)	Anonymous (Undated$_f$)
	Summer (1985)	67.7% (N=93)	Anonymous (Undated$_f$)
	Winter (1986)	52.0% (N=100)	Anonymous (Undated$_f$)
	Summer (1987)	43.8%	Anonymous (Undated$_f$)
	Summer (1992)	52.5% (N=101)	Anonymous (Undated$_f$)
	Summer (1994)	61.3% (N=142)	Anonymous (Undated$_f$)
Chiblow-Denman (Ontario)	Summer (1967)	0.0% (N=587)	Olver (1967)
Clear (Ontario)	Summer (1983)	57.9% (N=19)	OFIS records
	Summer (1984)	50.0% (N=10)	OFIS records
	Winter (1985)	20.0% (N=25)	OFIS records
	Summer (1985)	2.7% (N=37)	OFIS records
	Winter (1986)	6.0% (N=83)	OFIS records
	Summer (1986)	8.0% (N=25)	OFIS records
	Winter (1987)	0.0% (N=31)	OFIS records
	Summer (1987)	0.0% (N=40)	OFIS records
	Winter (1988)	18.8% (N=16)	OFIS records
	Summer (1988)	0.0% (N=17)	OFIS records
Cliff (Ontario)	Summer (1950)	2.7%	Armstrong (1950)
Crystal (Ontario)	Winter (1991)	0.0% (N=33)	Kerr (1991)
Deer (Ontario)	Winter (1991)	89.0% (N=73)	OFIS records
Devil (Ontario)	Winter (1981)	19.5% (N=41)	OFIS records
	Summer (1981)	4.0% (N=50)	OFIS records
	Winter (1982)	6.7% (N=30)	Schlesinger and MacLean (1983)
	Winter (1983)	16.4% (N=61)	Barnes et al. (1983)
	Summer (1983)	4.3% (N=47)	OFIS records
	Winter (1984)	9.6% (N=52)	Claytor et al. (1984)
	Winter (1985)	14.0% (N=50)	OFIS records
	Summer (1985)	11.8% (N=34)	OFIS records
	Winter (1986)	11.2% (N=107)	OFIS records
	Summer (1991)	0.0% (N=100)	OFIS records
	Summer (1992)	6.3% (N=79)	OFIS records
	Summer (1995)	4.9% (N=41)	OFIS records
Dickey (Ontario)	Winter (1983)	25.0% (N=137)	Anonymous (1983)
	1981-1985	13.5-68.0% (mean=28%)	Stewart (1987)
Drag (Ontario)	Winter (1981)	9.0%	Loftus (1982)
Eels (Ontario)	Summer (1983)	12.9% (N=31)	OFIS records
	Winter (1984)	62.5% (N=56)	OFIS records
	Spring (1984)	28.9% (N=76)	Irwin (1985)

Lake	Season/Year	% Stocked Fish in Catch	Reference(s)
Eels Lake (cont'd)	Summer (1988)	43.4% (N=76)	OFIS records
	Summer (1989)	31.4% (N=35)	OFIS records
	Summer (1990)	11.8% (N=17)	OFIS records
	Summer (1991)	65.4% (N=26)	OFIS records
Faraday (Ontario)	Winter (1983)	24.6%	Irwin (1983); OFIS records
	Winter (1990)	87.1% (N=93)	OFIS records
Farquhar (Ontario)	Winter (1989)	40.4% (N=99)	OFIS records
Fern (Ontario)	Winter (1969)	100.0% (N=45)	Hall (1969)
Flack (Ontario)	Summer-Fall (1968)	0.1% (N=739)	Purych (1975$_b$)
	Summer-Fall (1969)	0.5% (N=586)	Purych (1975$_b$)
	Summer-Fall (1970)	0.3% (N=653)	Purych (1975$_b$)
	Summer-Fall (1971)	0.4% (N=849)	Purych (1975$_b$)
	Summer-Fall (1972)	0.1% (N=888)	Purych (1975$_b$)
	Summer-Fall (1973)	0.0% (N=833)	Purych (1975$_b$)
	Summer-Fall (1974)	0.3% (N=387)	Purych (1975$_b$)
Fowke (Ontario)	Winter (1978)	12.5% (N=16)	Unpublished data
Gillies (Ontario)	Summer (1968)	2.9% (N=34)	Kerr (1983)
	Winter (1975)	39.1% (N=46)	Kerr (1983)
	Winter (1976)	43.4% (N=99)	Kerr (1983)
	Summer (1976)	76.9% (N=26)	Kerr (1983)
	Winter (1978)	61.5% % (N=26)	Kerr (1983)
	Fall (1979)	81.2% (N=16)	Kerr (1983)
	Winter (1983)	66.7% (N=24)	Kerr (1983)
	Winter (1985)	64.3% (N=84)	Kerr (1985)
	Winter (1986)	65.2% (N=63)	Kerr (1986)
Gong (Ontario)	Summer (1983)	0.0% (N=33)	OFIS records
	Summer (1984)	5.0% (N=40)	OFIS records
	Summer (1985)	7.7% (N=26)	OFIS records
	Summer (1988)	3.1% (N=32)	OFIS records
	Summer (1989)	7.1% (N=28)	OFIS records
Grace (Ontario)	Winter (1988)	66.7% (N=81)	OFIS records
Grass (Ontario)	Winter (1991)	50.0% (N=12)	OMNR file data
Hungry (Ontario)	Winter (1991)	100.0% (N=27)	Kerr (1991)
	Winter (1992)	95.0% (N=20)	Kerr (1992)
Jimchrist (Ontario)	Summer (1968)	7.7% (N=39)	Purych (1973)
	Summer (1969)	2.1% (N=97)	Purych (1973)
	Summer (1970)	0.0% (N=167)	Purych (1973)
	Summer (1971)	0.0% (N=31)	Purych (1973)
	Summer (1972)	0.0% (N=13)	Purych (1973)
Joseph (Ontario)	Winter (1988)	1.3% (N=315)	OFIS records
	Spring and Summer (1988)	0.0% (N=28)	OFIS records

Lake	Season/Year	% Stocked Fish in Catch	Reference(s)
Joseph Lake (cont'd)	Winter (1989)	4.0% (N=176)	OFIS records
	Summer (1989)	4.4% (N=45)	OFIS records
	Winter (1990)	3.3% (N=307)	OFIS records
	Summer (1990)	5.8% (N=52)	OFIS records
	Winter (1991)	100.0% (N=10)	OFIS records
	Summer (1991)	0.0% (N=34)	OFIS records
	Winter (1992)	5.9% (N=152)	OFIS records
	Summer (1992)	0.0% (N=52)	OFIS records
	Winter (1993)	1.7% (N=118)	OFIS records
	Winter (1998)	0.0% (N=105)	OFIS records
Kimball (Ontario)	Spring and Summer (1983)	0.0% (N=35)	OFIS records
	Winter (1984)	7.7% (N=26)	OFIS records
	Spring (1984)	4.0% (N=25)	OFIS records
	Winter (1985)	0.0% (N=63)	OFIS records
	Spring and Summer (1985)	3.1% (N=65)	OFIS records
	Winter (1986)	5.1% (N=59)	OFIS records
	Spring and Summer (1986)	4.3% (N=92)	OFIS records
	Spring and Summer (1987)	3.8% (N=80)	OFIS records
	Spring and Summer (1988)	1.3% (N=79)	OFIS records
Koshlong (Ontario)	Winter (1981)	87.0% (N=77)	Loftus (1982)
	Summer-Fall (1981)	0.0% (N=22)	Loftus and Rubie (1982)
Lake of Bays (Ontario)	Winter (1996)	100.0% (N=56)	OFIS records
Larder (Ontario)	Winter (1980)	2.3%	Renaud (1980)
L'Amable (Ontario)	Winter (1984)	60.7% (N=28)	Burris and Brisbane (1985)
	Spring (1985)	35.3% (N=17)	Burris and Brisbane (1985)
	Summer (1986)	47.6% (N=17)	Anonymous (1986)
Limerick (Ontario)	Winter (1989)	75.5% (N=49)	OFIS records
Little Hawk (Ontario)	Winter and summer (1979)	2.9%	Bradbury (1979)
Little Ossipee (Maine)	Winter (1959, 1960, 1961)	62.0%	Anderson (1986)
Long (Ontario)	Winter (1992)	64.0% (N=25)	OFIS records
Loon (Ontario)	Winter (1991)	0.0% (N=18)	OMNR file data
Lucky (Ontario)	Winter (1992)	47.4% (N=19)	Kerr (1992)
Manitou (Ontario)	Winter (1965)	~90%	Zimmerman (1965)
	Winter (1966)	92.3%	Zimmerman (1967)
	Winter (1967)	77.5%	Zimmerman (1967)

Lake	Season/Year	% Stocked Fish in Catch	Reference(s)
Lake Manitou (cont'd)	Winter (1968)	78.0%	Zimmerman (1969)
	Winter (1970)	24.8% (N=495)	Cheley (1970)
	Winter (1971)	51.3%	Matz (1971)
	Winter (1974)	80.0%	Beange (1974)
	Winter (1975)	81.6%	Beange (1976_a)
	Winter (1976)	90.0%	Beange (1976_b)
	Winter (1978)	88.8% (N=216)	Beange (1978)
	Winter (1982)	97.9%	Diebolt (1982)
	Summer (1982)	94.0%	Barnes (1982)
	Winter (1990)	72.6% (N=153)	OFIS records
Margaret (Ontario)	Winter and Summer (1979)	33.0%	Bradbury (1979)
McCann (Ontario)	Winter (1983)	42.0% (N=47)	OMNR file data
McCausland (Ontario)	Winter (1991)	18.2% (N=22)	Kerr (1991)
Mephisto (Ontario)	Winter (1984)	85.7% (N=14)	Burris et al. (1985)
Miskoway (Ontario)	Winter (1978)	75.0% (N=36)	Unpublished data
Muskoka (Ontario)	Winter (1992)	92.9% (N=99)	OFIS records
	Winter (1993)	100.0% (N=32)	OFIS records
Net (Ontario)	Winter (1981)	0.0% (N=76)	Read (1981)
Nunikani (Ontario)	Winter and Summer (1979)	0.0%	Bradbury (1979)
	Spring and Summer (1983)	0.0% (N=10)	OFIS records
	Spring (1984)	0.0% (N=15)	OFIS records
	Spring and Summer (1985)	19.0% (N=42)	OFIS records
O'Dell (Oregon)	1951	44.0%	Gerlach (1967)
	1963	>50.0%	Gerlach (1963)
	1952-1963	4.0-74.0%	Gerlach (1963)
Opeongo (Ontario)	1948-1964	< 0.01%	Anonymous (1970_a)
	1961, 1963, 1964	0.04%	Anonymous (1970_a)
	Spring and Summer (1990)	0.4% (N=458)	OFIS records
	Spring and Summer (1991)	1.1% (N=726)	OFIS records
Palmerston (Ontario)	Winter (1991)	75.7% (N=70)	Kerr (1991)
	Winter (1992)	73.5% (N=83)	Kerr (1992)
Papineau (Ontario)	Winter (1984)	0.0% (N=43)	Burris et al. (1985)

Lake	Season/Year	% Stocked Fish in Catch	Reference(s)
Penage (Ontario)	Winter (1965)	60.0%	Hughson (1965)
Perry (Ontario)	Winter (1971)	57.0% (N=91)	Himburg (1971)
Ranger (Ontario)	Winter and Summer (1968)	0.0%	Samis (1968_a)
Rathbun (Ontario)	Winter (1983)	88.2% (N=17)	OFIS records
Raven (Ontario)	Winter and Summer (1979)	33.0%	Bradbury (1979)
Redhorse (Ontario)	Winter (1970)	85.0% (N=194)	Raine (1975)
	Winter (1971)	72.0% (N=113)	Raine (1975)
	Winter (1975)	50.0% (N=14)	Raine (1975)
Red Pine (Ontario)	Summer and Winter (1979)	0.0%	Bradbury (1979)
Rosseau (Ontario)	Winter (1988)	40.7% (N=108)	OFIS records
	Winter (1989)	21.1% (N=109)	OFIS records
	Winter (1990)	33.9% (N=180)	OFIS records
	Winter (1991)	100.0% (N=142)	OFIS records
	Winter (1992)	31.7% (N=142)	OFIS records
	Summer (1992)	40.0% (N=10)	OFIS records
	Winter (1993)	100.0% (N=21)	OFIS records
	Winter (1994)	100.0% (N=37)	OFIS records
	Winter (1996)	6.7% (N=45)	OFIS records
	Winter (1997)	8.7% (N=23)	OFIS records
	Winter (1998)	0.0% (N=55)	OFIS records
Semiwite (Ontario)	Summer and Fall (1968)	0.8% (N=251)	Olver (1971_f)
	Summer (1969)	0.1% (N=149)	Olver (1971_d)
	Summer (1970)	0.4% (N=231)	Olver (1971_e)
	Summer (1971)	0.0% (N=322)	Olver (1971_f)
Sharbot (Ontario)	Winter (1981)	47.9%	Ridout (1981)
Shelborne (Ontario)	Winter and Summer (1979)	18.0%	Bradbury (1979)
Sherborne (Ontario)	Spring and Summer (1983)	0.0% (N=17)	OFIS records
	Winter (1984)	0.0% (N=13)	OFIS records
	Spring (1984)	8.3% (N=12)	OFIS records
	Spring and Summer (1985)	16.7% (N=18)	OFIS records
	Winter (1986)	42.9% (N=21)	OFIS records
	Spring and Summer (1986)	36.7% (N=30)	OFIS records
	Winter (1987)	20.0% (N=15)	OFIS records
	Spring and Summer (1987)	0.0% (N=10)	OFIS records

Lake	Season/Year	% Stocked Fish in Catch	Reference(s)
Sherborne Lake (cont'd)	Winter (1988)	17.7% (N=17)	OFIS records
	Spring and Summer (1988)	18.2% (N=11)	OFIS records
Shoal (Ontario)	Spring (1996)	100.0% (N=96)	OFIS records
Silent (Ontario)	Summer (1982)	44.0% (N=15)	Gillap (1983)
	Winter (1983)	59.8% (N=82)	Irwin (1983)
	Summer (1983)	31.3% (N=16)	Burris (1985); OFIS records
	Summer (1985)	7.1% (N=70)	Irwin and Brisbane (1988)
	Winter (1991)	75.7% (N=103)	OFIS records
Silver (Ontario)	Winter (1978)	63.8% (N=36)	OMNR file data
Simcoe (Ontario)	Winter (1974)	24.0% (N=62)	Stewart (1995)
	Winter (1975)	13.3% (N=60)	Stewart (1995)
	Winter (1976)	62.2% (N=199)	Stewart (1995)
	Winter (1977)	62.7% (N=536)	Stewart (1995)
	Winter (1978)	70.0% (N=637)	Stewart (1995)
	Summer (1978)	69.0%	Sutherland and Lawrence (1978)
	Winter (1979)	76.4% (N=334)	Stewart (1995)
	Winter (1980)	90.8% (N=76)	Stewart (1995)
	Winter (1981)	76.8% (N=468)	Stewart (1995)
	Winter (1982)	92.3% (N=390)	Stewart (1995)
	Winter (1983)	93.8% (N=848)	Stewart (1995)
	Winter (1986)	90.1% (N=71)	Stewart (1995)
	Winter (1987)	97.5% (N=400)	Stewart (1995)
	Winter (1988)	97.2% (N=36)	Stewart (1995)
	Summer (1988)	96.0%	Arndt (1989)
	Winter (1989)	92.5% (N=656)	Stewart (1995)
	Winter (1990)	98.3% (N=117)	Stewart (1995)
	Winter (1991)	99.7% (N=667)	Stewart (1995)
	Winter (1992)	94.0% (N=50)	Stewart (1995)
	Winter (1993)	99.3% (N=270)	Stewart (1995)
	Winter (1994)	100.0% (N =157)	Stewart (1995)
	Winter (1995)	100.0% (N=100)	OMNR file data
	Winter (1996)	99.4% (N=175)	OMNR file data
	Winter (1997)	100.0% (N=508)	OMNR file data
	Winter (1998)	98.4% (N=62)	OMNR file data
	Winter (1999)	100.0% (N=359)	OMNR file data
	Winter (2000)	100.0% (N=427)	OMNR file data
Skeleton (Ontario)	Winter (1994)	100.0% (N=50)	OFIS records
Smoke (Ontario)	Spring (1996)	30.0% (N=10)	OFIS records
Star (Ontario)	Winter (1977)	84.5% (N=71)	Unpublished data
	Winter (1978)	37.0% (N=27)	Unpublished data
St. Nora (Ontario)	Winter and Summer (1979)	50.0%	Bradbury (1979)

Lake	Season/Year	% Stocked Fish in Catch	Reference(s)
St. Peter (Ontario)	Winter (1984)	35.3% (N=17)	OFIS records
	Winter (1985)	29.0%	Burris et al. (1985)
Temagami (Ontario)	Summer (1966)	0.0% (N=390)	Jorgensen (1973$_a$)
	Winter (1967)	0.2% (N=483)	Jorgensen (1973$_a$)
	Summer (1967)	0.4% (N=805)	Jorgensen (1973$_a$)
	Winter (1968)	0.3% (N=318)	Jorgensen (1973$_a$)
	Winter (1969)	0.0% (N=395)	Jorgensen (1973$_a$)
	Winter (1971)	0.5% (N=430)	Jorgensen (1973$_a$)
Thanet (Ontario)	Winter (1983)	7.7% (N=13)	Anonymous (1983)
Trout (Ontario)	Winter (1989)	59.9% (N=284)	OFIS records
	Winter (1990)	80.0% (N=100)	OFIS records
Twelvemile (Ontario)	Winter (1981)	23.5% (N=34)	Loftus (1982)
Upper Kushog (Ontario)	Winter and Summer (1979)	60.0%	Bradbury (1979)
Wakomata (Ontario)	Winter (1968)	0.0% (N=37)	Samis (1968$_b$)
Watabeag (Ontario)	Winter (1980)	13.1%	Renaud (1980)
Wawa (Ontario)	Winter (1980)	5.6% (N=18)	Kerr (1980)
	Winter (1981)	6.7% (N=15)	Kerr (1981)
	Winter (1982)	20.0% (N=10)	Kerr (1982)
Whitefish (Ontario)	Winter (1978)	79.4% (N=39)	Unpublished data
Wollaston (Ontario)	Spring (1980)	20.0% (N=10)	OFIS records
	Winter (1983)	12.8% (N=180)	Irwin (1985); OFIS records
	Spring (1984)	7.0% (N=57)	OFIS records
	Winter (1989)	29.0% (N=93)	OFIS records
	Spring (1989)	26.3% (N=99)	OFIS records
	Winter (1990)	27.3% (N=22)	OFIS records
	Spring (1990)	21.9% (N=64)	OFIS records
	Winter (1991)	42.2% (N=161)	OFIS records
	Spring (1991)	24.1% (N=58)	OFIS records
Misc. lakes (Sweden)	1959-1983	0.0-60.0%	Gönczi and Nilsson (1983)

OFIS – Ontario Fisheries Information System

APPENDIX 4. Contribution of hatchery-reared lake trout to spawning stocks in selected waters.

Lake	Year	No. of Spawning Fish Examined	% Stocked Fish	Reference
Anstruther (Ontario)	1988	48	4.2%	Dosser (1989)
	1989	200	3.5%	OFIS records
Big Rideau (Ontario)	1990	132	9.1%	OFIS records
	1991	17	23.5%	OFIS records
	1992	25	0.0%	OFIS records
	1995	117	17.1%	OFIS records
	1998	81	8.6%	OMNR file data
	Multi-year	-	20%	Hoyle (1990)
Buzzard (Ontario)	1988	10	0.0%	Dosser (1989)
	1994	67	77.6%	OFIS records
Cashel (Ontario)	1986	22	50.0%	Dosser and Brisbane (1987)
Chandos (Ontario)	1983	18	11.1%	OFIS records
Charleston (Ontario)	1980	27	11.1%	Kerr (1999)
	1981	51	3.9%	Kerr (1999)
	1983	33	6.1%	Kerr (1999)
	1987	91	3.3%	Kerr (1999)
	1988	95	3.2%	Kerr (1999)
	1993	203	30.0%	Kerr (1999)
	1994	178	7.9%	Kerr (1999)
	1995	52	21.2%	Kerr (1999)
	1996	34	11.8%	Kerr (1999)
	1997	99	13.1%	Kerr (1999)
	1998	103	35.0%	Kerr (1999)
	2000	211	58.3%	OMNR file data
Devil (Ontario)	1986	266	1.1%	OFIS records
	1987	66	1.5%	OFIS records
	1988	12	0.0%	OFIS records
	1995	114	1.8%	OFIS records
	Multi-year	836	<2%	Hoyle (1990)
Eels (Ontario)	1985	19	5.3%	OFIS records
	1990	62	24.2%	OFIS records
Gillies (Ontario)	1983	14	14.3%	Perron (1984)
Grouse (Ontario)	1994	23	100.0%	OFIS records
	1995	43	100.0%	OFIS records
	1996	29	100.0%	OFIS records
Higgins (Michigan)	1958	177	88.1%	Jacob (1964)
	1959	185	70.3%	Jacob (1964)
	1960	235	82.1%	Jacob (1964)
	1962	107	93.5%	Jacob (1964)
Holland (Ontario)	1992	14	7.1%	OFIS records
Hudson (Ontario)	1989	11	54.5%	OFIS records
Limerick (Ontario)	1986	12	30.8%	Dosser and Brisbane (1987)

Lake	Year	No. of Spawning Fish Examined	% Stocked Fish	Reference
Limestone (Ontario)	1987	19	68.0%	Dosser (1987)
Little Gull (Ontario)	1986	22	100.0%	OFIS records
Manitou (Ontario)	1959	3,197	52.2%	Henderson (1982)
	1960	3,475	52.0%	Henderson (1982)
	1961	2,571	56.7%	Henderson (1982)
	1962	2,642	65.8%	Henderson (1982)
	1963	3,892	64.3%	Henderson (1982)
	1964	5,769	59.0%	Henderson (1982)
	1965	8,271	49.6%	Henderson (1982)
	1966	5,143	54.1%	Henderson (1982)
	1967	11,537	19.3%	Henderson (1982)
	1968	5,838	88.1%	Henderson (1982)
	1969	2,919	83.3%	Henderson (1982)
	1970	5,213	82.7%	Henderson (1982)
	1971	3,128	53.3%	Henderson (1982)
	1972	8,132	41.9%	Henderson (1982)
	1973	14,526	45.0%	Henderson (1982)
	1974	17,097	69.1%	Henderson (1982)
	1975	12,371	69.7%	Henderson (1982)
	1976	5,560	78.7%	Henderson (1982)
	1977	6,534	88.3%	Henderson (1982)
	1978	13,483	86.6%	Henderson (1982)
	1979	10,286	87.2%	Henderson (1982)
Mephisto (Ontario)	1983	12	33.3%	OFIS records
Odell (Oregon)	1961	-	16.4%	Gerlach (1962)
	1962	-	39.5%	Gerlach (1962)
Pettit (Ontario)	1986	10	100.0%	OFIS records
Silent (Ontario)	1982	12	33.3%	OFIS records
Simcoe (Ontario)	1978	147	98.0%	Ferguson (1978)
		451	89.5%	Amtstaetter (1999$_b$)
	1979	477	89.1%	Desjardine (1979)
	1980	250	91.7%	Amtstaetter (1999$_a$)
	1981	589	95.2%	Amtstaetter (1999$_a$)
	1982	358	97.3%	Amtstaetter (1999$_a$)
	1983	724	98.3%	Amtstaetter (1999$_a$)
	1984	1522	97.5%	Amtstaetter (1999$_a$)
	1985	1487	97.9%	Amtstaetter (1999$_a$)
	1986	1504	98.1%	Amtstaetter (1999$_a$)
	1987	2398	99.0%	Amtstaetter (1999$_a$)
	1988	562	99.3%	McMurtry (1989)
	1989	2066	99.4%	Amtstaetter (1999$_a$)
	1991	3374	99.5%	Amtstaetter (1999$_a$)
	1992	2393	99.9%	Amtstaetter (1999$_a$)
	1993	3879	99.6%	Amtstaetter (1999$_a$)
	1994	1617	99.9%	Amtstaetter (1999$_a$)
	1995	1973	99.9%	Amtstaetter (1999$_a$)
	1996	2104	99.8%	Amstaetter (1999$_a$)
	1997	1560	99.9%	Amtstaetter (1999$_a$)
	1998	1191	100.0%	OMNR file data
	1999	1822	99.9%	OMNR file data

Lake	Year	No. of Spawning Fish Examined	% Stocked Fish	Reference
Wawa (Ontario)	1980	27	0.0%	Kerr (1981)
Wollaston (Ontario)	1988	49	2.0%	Dosser (1989)

MNR 51463
(0.3k P.R. 01 15 01)
ISBN 0-7794-0490-4